

## CHAPTER 4

# FIRST AID AND EMERGENCY PROCEDURES

### GENERAL CONSIDERATIONS

For a Navy Corpsman, first aid and emergency procedures are the professional care of the sick and injured before definitive medical attention can be obtained. Appropriate care may range from an encouraging word to a dramatic struggle to draw a person back from the brink of death. At all times, however, it must be remembered that first aid measures are temporary expedients whose purpose is to save life, to prevent further injury, and to preserve resistance and vitality. These measures are not meant to replace proper medical diagnosis and treatment procedures. A corpsman who understands this point, who knows the limits of the professional care a corpsman can offer, and who is motivated to keep abreast of new first aid equipment and procedures will be able to provide the competent care that will make the differences between life or death, temporary or permanent injury, and rapid recovery or long-term disability.

### GENERAL FIRST AID RULES

There are a few general first aid rules that you should follow in any emergency:

1. Take a moment to get organized. On your way to an accident scene, use a few seconds to remember the basic rules of first aid. Remain calm as you take charge of the situation, and act quickly but efficiently. Decide as soon as possible what has to be done and which one of the patient's injuries needs attention first.
2. Unless contraindicated, make your preliminary examination in the position and place you find the victim. Moving the victim before this check could gravely endanger life, especially if the back or ribs are broken. Of course, if the situation is such that you or the victim is in danger, you must weigh this threat against the potential damage caused by premature transportation. If you decide to move the victim, do it quickly and gently to a safe location where proper first aid can be administered.
3. In a multivictim situation, limit your preliminary survey to observing for airway patency, breathing, and circulation—the immediate life-threatening conditions. Remember, irreversible brain damage can occur within 4 to 6 minutes if breathing has stopped. Bleeding from a severed artery can lethally drain the body in even less time. If both are present and you are alone, quickly handle the major hemorrhage first, and then work to get oxygen back into the system. Shock may allow the rescuer a few minutes of grace but is no less deadly in the long run.
4. Examine the victim for fractures, especially in the skull, neck, spine, and rib areas. If any are present, prematurely moving the patient can easily lead to increased lung damage, permanent injury, or death. Fractures of the innominate bone or extremities, though not as immediately life-threatening, may pierce vital tissue or blood vessels if mishandled.
5. Remove enough clothing to get a clear idea of the extent of the injury. Rip along the seams, if possible, or cut. Removal of clothing in the normal way may aggravate hidden injuries. Respect the victim's modesty as you proceed, and do not allow the victim to become chilled.
6. Keep the victim reassured and comfortable. If possible, do not allow the victim to see the wounds. The victim can endure pain and discomfort better if confident in your abilities. This is important because under normal conditions the corpsman will not have strong pain relief medications right at hand.
7. Avoid touching open wounds or burns with your fingers or unsterile objects, unless clean compresses and bandages are not available and it is imperative to stop severe bleeding.
8. Unless contraindicated, position the unconscious or semiconscious victim on his or her side or back, with the head turned to the side to minimize choking or the

aspirating of vomitus. Never give an unconscious person any substance by mouth.

9. Always carry a litter patient feet first so that the rear bearer can constantly observe the victim for respiratory or circulatory distress.

### **ASSESSING THE PATIENT'S CONDITION**

The following procedures for assessing a patient's condition under various circumstances are based upon Department of Transportation recommendations. These are general guidelines that can be modified to suit the situation.

### **DETERMINING THE PROBLEM**

- A. If the patient can communicate, determine if the problem is medical or trauma related.
  1. If medical, follow the sequence below.
    - a. Evaluate diagnostic and vital signs.
    - b. Develop the patient's history.
    - c. Examine for the medical problems.
    - d. Examine for a trauma-related problem.
  2. If trauma-related, follow the sequence below.
    - a. Evaluate diagnostic and vital signs.
    - b. Examine the injury.
    - c. Develop the patient's history.
    - d. Examine for a medical related problem.
- B. If the patient cannot communicate, follow the sequence below.
  1. Evaluate diagnostic and vital signs.
  2. Develop the patient's history, then determine if the problem is medical or trauma related.
  3. If medical, examine first for the medical problem then for a trauma related problem.
  4. If trauma related, examine first for the trauma related problem then for a medical problem.

### **EVALUATING THE DIAGNOSTIC AND VITAL SIGNS**

- A. Sequence of taking vital signs
  1. If the patient with a traumatic injury is communicative, assess the injury site after taking vital signs.
  2. If the patient with a medical problem is communicative, take vital signs after the preliminary assessment and in conjunction with the medical history, if possible.
  3. If the patient is noncommunicative, take vital signs immediately after the primary assessment.
- B. Essential diagnostic and vital signs
  1. Mental status
    - a. Consciousness—avoid descriptive words like “stupor” or “semi-conscious”; be specific.
    - b. Reaction to stimulus—describe
    - c. Orientation
    - d. Responsiveness
  2. Respirations
    - a. Tracheal deviation
    - b. Rate—tachypnea
    - c. Depth
      - (1) Hyperpnea
      - (2) Hypopnea
    - d. Dyspnea
    - e. Breathing sounds
    - f. Flaring of anterior nares on inspiration
    - g. Retraction of suprasternal notch on inspiration
    - h. Retraction of intercostal spaces
  3. Pulse
    - a. Rate
    - b. Rhythm
    - c. Strength
  4. Blood pressure

### **EXAMINING FOR TRAUMA-RELATED PROBLEMS**

- A. Assess each of the following
  1. Head
    - a. Inspect for
      - (1) Obvious hemorrhage
      - (2) Ecchymosis, erythema, or contusions
      - (3) Scalp lesions

- b. Gently palpate for
      - (1) Lumps
      - (2) Depressions
      - (3) Pain on compression of skull  
(Do not compress if patient is noncommunicative!)
  2. Eyes
    - a. Inspect for
      - (1) Laceration to lid or globe
      - (2) Foreign matter in eye
      - (3) Unequal pupils (anisocoria)
      - (4) Eye movements
      - (5) Pupillary reaction
    - b. Palpate for
      - (1) Swelling in orbital or periorbital area
      - (2) Failure to sense touch in supra-orbital and infraorbital areas if patient is communicative
  3. Ear—inspect for
    - a. Discharge from external auditory canal
    - b. Ecchymosis over mastoid (Battle's sign)
    - c. Lacerations
    - d. Bleeding
  4. Nose—inspect for
    - a. Rhinorrhea
    - b. Patent nostrils
    - c. Bleeding
    - d. Flaring of anterior nares on inspiration
  5. Mouth
    - a. Inspect for
      - (1) Potential airway obstruction
      - (2) Edema or hemotoma
      - (3) Bleeding
      - (4) Teeth or dentures lodged in pharynx
      - (5) Misalignment of teeth
      - (6) Pain when biting teeth together
    - b. Palpate for fractures
      - (1) Zygomatic bones
      - (2) Mandible
      - (3) Maxilla
  6. Neck
    - a. Inspect for
      - (1) Retraction at suprasternal notch on inspiration
      - (2) Deviation of trachea from midline
    - b. Auscultate for air sounds in trachea
  7. Skin—inspect for
    - a. Jaundice
    - b. Cyanosis
    - c. Diaphoresis
    - d. Temperature
    - e. Moistness
    - f. Pallor
  8. Thorax
    - a. Inspect for
      - (1) Respiration
        - (a) Rate—tachypnea
        - (b) Depth
          - 1 Hyperpnea
          - 2 Hypopnea
        - (c) Retraction of intercostal spaces
      - (2) Chest elevation symmetry—flail chest
      - (3) Lacerations, puncture, or ecchymosis
    - b. Palpate (unless there is a suspected spinal injury)
      - (1) Vertebrae and ribs for symmetry and tenderness
      - (2) Anterior to posterior compression of thorax
      - (3) Lateral-to-lateral compression of thorax
      - (4) Compression of clavicle
      - (5) Cranial to chordal compression
      - (6) Pressure of costochondral junction
      - (7) Compression on costovertebral angles
    - c. Auscultate for lung and heart sounds
      - (1) Lung sounds
        - (a) Absent or unequal breath
        - (b) Characteristics
          - 1 Rales
          - 2 Rhonchi
          - 3 Wheezes
          - 4 Strider
      - (2) Heart sounds
    - d. Percussion
      - (1) Fluid in thorax
      - (2) Pneumothorax or collapsed lung
  9. Abdomen
    - a. Inspect for
      - (1) Lacerations, ecchymosis, burns, etc.
      - (2) Hematoma
      - (3) Flexion of hips to relieve pain
    - b. Auscultate bowel sounds

- c. Palpate firmly for
    - (1) Distended abdomen
    - (2) Guarding
    - (3) Local tenderness
    - (4) Rebound pain
- 10. Extremities
  - a. Inspect for
    - (1) Abnormal angulation or bone ends protruding
    - (2) Presence of extremity pulse
      - (a) Dorsalis pedis
      - (b) Radial
    - (3) Nail bed color (cyanosis)
    - (4) Impaired sensation
    - (5) Inability to move joint
    - (6) Lacerations or ecchymosis
    - (7) Needle marks or bites
  - b. Palpate for abnormal reaction
- 11. Central nervous system
  - a. Inspect for
    - (1) Mental state
      - (a) Consciousness
      - (b) Orientation
      - (c) Response to verbal stimulus and pain
    - (2) Gross deformities
    - (3) Lacerations
    - (4) Decerebrate posturing
    - (5) Decorticate posturing
  - b. Palpate for
    - (1) Tenderness
    - (2) Deformities
- 3. Thorax and heart—auscultate for abnormal heart sounds
- 4. Abdomen
  - a. Inspect for
    - (1) Flexion of hips to relieve pain
    - (2) Normal contour during breathing
    - (3) Distention
  - b. Auscultate for bowel sounds
  - c. Palpate for
    - (1) Distention
    - (2) Guarding
    - (3) Local tenderness
    - (4) Rebound pain
- 5. CNS
  - a. Inspect for
    - (1) Mental state
    - (2) Pupil reaction
    - (3) Eye movements
    - (4) Muscle tone
    - (5) Paralysis
  - b. Palpate for
    - (1) Loss of feeling
    - (2) Absent reflexes
    - (3) Muscle tone
    - (4) Paralysis

## EXAMINING FOR MEDICAL PROBLEMS

### A. Assess each of the following areas

- 1. Neck
  - a. Inspect for jugular vein distention
  - b. Auscultate trachea for adequate airflow
- 2. Thorax and lungs
  - a. Inspect for evidence of pain while breathing or moving
  - b. Auscultation
    - (1) Rales
    - (2) Rhonchi
    - (3) Wheezes
    - (4) Stridor
  - c. Palpate to determine symmetry of breathing
  - d. Percuss for
    - (1) Hemothorax
    - (2) Pneumothorax

## DEVELOPING THE MEDICAL HISTORY

The patient's history is an important information source that will directly influence both the treatment offered by the corpsman at the accident scene and the care given in the hospital. The history is acquired at the accident scene and the care given in the hospital. The history is acquired by observing for clues and careful questioning of the patient, family, and bystanders. A history is divided into three parts: the history of the immediate situation, the patient's medical history, and the family medical history. (The family history is usually not relevant in the field with a trauma patient.)

A history of the present illness is a directed history, striking a balance between allowing the patient to ramble and leading the patient. The purpose is to discover why you were called. In general, the following information must be gathered:

- A. Gross problem identification
  - 1. Chief complaint
  - 2. How does the patient feel?

- B. Location of the problem
  - 1. Pain
  - 2. Other symptoms (e.g., dizziness or shortness of breath)
- C. Quality of symptom(s)
  - 1. How does it feel?
  - 2. What does it resemble?
- D. Quantity of symptom(s)
  - 1. Pain intensity
  - 2. Effect on normal functioning
- E. Chronology of symptom(s)
  - 1. Time of onset
  - 2. Duration
  - 3. Frequency
- F. Cause of trauma
  - 1. What happened?
  - 2. Any contributing physical cause?
  - 3. How did injury take place (e.g., patient's head hit corner of table during fall)?
- G. Scenario of first medical symptoms
  - 1. Where did first symptoms occur?
  - 2. What was the patient doing?
- H. Aggravating and alleviating movements
- I. Associated complaints
  - 1. Other symptoms
  - 2. Affected normal body functions

The following are components of a complete history of a patient's medical problems:

- A. General health before the current problem
- B. Name of family physician or location of health records
- C. Current medications and treatments
- D. Recent injuries
- E. Allergies
- F. Family medical history
  - 1. General health of family members
  - 2. Recent family illnesses

## FIRST AID EQUIPMENT AND SUPPLIES

In a first aid situation, the corpsman must always be ready to improvise. In the majority of emergency situations, standard medical supplies and equipment will not be immediately available or they may run out. Later sections of this chapter will discuss how material can be used as substitutes.

When medical supplies and equipment are available, they will probably be found in an ambulance or in the field medical Unit One bag.

Navy ambulances are stocked in accordance with NAVMEDCOMINST 6700.9. Table 4-1 lists equipment currently required. Table 4-2 lists the

**Table 4-1.—Minimum first aid equipment and supplies stocked in a Navy ambulance**

Patient transfer litters

- 1. wheeled litter
- 2. folding or collapsible litter

Airway, pharyngeal, adult, child, infant

Ambu bag with masks, adult, child, infant

Suction equipment, portable and installed

Oxygen inhalation equipment, installed and portable

- 1. oxygen masks, adult, child, infant
- 2. humidifier
- 3. connecting tubing
- 4. regulator and flowmeter

Spine boards, long and short

Sterile obstetrical delivery pack Splinting material

- 1. pneumatic extremity splints
- 2. Thomas half-ring or Hare traction splint
- 3. MAST (pneumatic counter-pressure device)

Wound dressing supplies

Acute poisoning kit with activated charcoal and syrup of ipecac in premeasured doses

Eye irrigation equipment

Snakebite kit as determined by local policy

General basic supplies to include pillows, pillowcases, sheets, towels, emesis basin, disposable tissues, bedpan, thermometer, drinking cups, sandbags, blankets, stethoscopes, sphygmomanometer

**Table 4-2.—Contents of an ambulance emergency bag**

Regular drip	Mini drip
18-gauge Medicut	Ace wrap
16-gauge Medicut	20-gauge needles
Airways (Various sizes)	Syrup of Ipecac
Sodium chloride ampules	10 cc syringes
19-gauge butterflies	Trach adapter
Y-connector	Straight connector
Tourniquet	Safety pins
Tongue blades	Alcohol swabs
Klings	Tape
Ammonia ampules	Arm slings
Stethoscope	Extension tubing
Examination gloves	Suction tube
Adult mask	Oxygen tubing
Nasal cannula	4 X 4s
Lubricant	Toomey syringe
Ambu bag	Grease pencil

**Table 4-3.—Medical instrument and supply set, individual (Unit One)**

- a. Descriptions
  - (1) weight 9 lbs
  - (2) four strong compartments
  - (3) adjustable carrying strap
  - (4) made of nylon
- b. Contents
  - (1) one role wire fabric, 5" X 36"
  - (2) two bottles of aspirin, 324 mg, 100s
  - (3) three packages of morphine inj. 1/4 g, 5s
  - (4) one bottle tetracaine hydrochloride ophthalmic sol.
  - (5) three bottles povidone-iodine sol. 1/2 fl oz.
  - (6) two packages atropine inj., 12s
  - (7) two muslin triangular bandages
  - (8) two medium battle dressings, 7 1/4 X 8
  - (9) eight small battle dressings 4 X 7
  - (10) one roll adhesive tape, 3" X 5 yds
  - (11) six packages of Band-Aids, 6s
  - (12) one pair scissors, bandage
  - (13) one tourniquet
  - (14) one airway, plastic adult/child
  - (15) one thermometer, oral
  - (16) one card of safety pins, medium, 12s
  - (17) one surgical instrument set, minor surgery
  - (18) two books field medical cards
  - (19) one pencil, black lead, mechanical
  - (20) two packages gauze, roller, 3" X 5 yds

contents of an emergency bag that a corpsman might find in an ambulance. Table 4-3 lists the contents of the Unit One bag.

Unique operational requirements or command decisions may modify the make-up of any of the lists. It is up to the corpsman to be familiar with the emergency medical equipment at the command, since the call may come at a moment's notice to use any of these items to help save or sustain a life.

### **TRIAGE**

A final general first aid consideration is triage. Triage is a French word meaning "picking, sorting, or choice" and is used to mean the evaluation and classification of casualties for the purpose of establishing priorities for treatment and evacuation. In the military, there are two basic types of triage: combat and noncombat. In each case, sorting decisions may vary, depending upon the

situation. The person in charge is responsible for the balancing of human lives against the realities of the tactical situation, the level of medical stock on hand, and the realistic capabilities of personnel. Triage is an ongoing process and decisions are made at every stage in the movement of the casualty.

### **SORTING FOR TREATMENT—TACTICAL**

The following discussion refers primarily to the battalion aid station (BAS), where helicopter or rapid land evacuation is not readily available, or to the shipboard battle-dressing station.

Immediately upon arrival, sort the casualties into groups in the order listed below:

Class I. Those whose injuries require minor professional treatment that can be done on an outpatient or ambulatory basis. These personnel can be returned to duty in a short period of time.

Class II. Those whose injuries require immediate lifesustaining measures or are of a moderate nature. Initially, they require a minimum amount of time, personnel, and supplies.

Class III. Those for whom definitive treatment can be delayed without jeopardy to life or loss of limb.

Class IV. The hopelessly wounded who would require extensive treatment beyond the immediate medical capabilities. Treatment of these casualties would be to the detriment of others.

### **SORTING FOR TREATMENT—NON-TACTICAL**

In a civilian or non-tactical situation, sorting of casualties is somewhat, but not significantly, different from a combat situation. There are three basic classes of injuries and the order of treatment is different.

Priority I. These casualties require immediate life sustaining action.

Priority II. These casualties generally have injuries where treatment can be delayed for a short time.

Priority III. These casualties generally have minor injuries or they have obviously mortal wounds where survival is not expected.

As mentioned before, triage is an ongoing process; depending on the treatment rendered, the

amount of time elapsed, and the constitution of the casualty, you may have to reassign priorities. What appears to be a minor wound on initial evaluation may develop into a profound shock, or a casualty that requires immediate treatment may be stabilized and down-graded to a delayed status.

## **SORTING FOR EVACUATION**

During the Vietnam war, the techniques of helicopter medical evacuation (MEDEVAC) were so improved that most casualties could be evacuated to a major medical facility within minutes of their injury. This considerably lightened the load of the hospital corpsman in the field, since provision for long-term care before the evacuation was not normally required. However, rapid aeromedical response did not relieve the corpsman of the responsibility for giving the best emergency care within the field limitations in order to stabilize the victim before the helicopter arrived. Triage was seldom a problem since most of the injured could be evacuated quickly.

New developments in warfare, along with changes in the probable theaters of deployment, indicate that the helicopter evacuation system may no longer be viable in a front-line environment. If this becomes the case, longer ground chains of evacuation to the BAS or division clearing station may be required. This will increase the need for the life stabilizing activities before each step in the chain and in transit. Evacuation triage will normally be for personnel in the Class II and Class III treatment categories, based on the tactical situation and the nature of the injuries. Class IV casualties may have to receive their treatment at the BAS level and Class I personnel would be treated on the line.

Remember, triage is based on the concept of saving the maximum number of personnel possible. In some cases, a casualty has the potential to survive, but the treatment necessary requires a great deal of time and supplies. As difficult as it may be, you may have to forsake this patient in order to save others that have a greater potential for survival.

## **BASIC LIFE SUPPORT**

Basic life support is the emergency techniques for recognizing and treating failures of the

respiratory system and heart function. The primary emphasis is placed on maintaining an open AIRWAY to counter upper airway obstruction; restoring BREATHING to counter respiratory arrest; and restoring CIRCULATION to counter cardiac arrest. These are the ABC's of basic life support.

## **UPPER AIRWAY OBSTRUCTION**

The assurance of breathing takes precedence over all other emergency care measures. The reason for this is simple: If a person cannot breathe, he or she cannot survive.

Many factors can cause the patient's airway to become fully or partially obstructed. In the adult, a very common cause of obstruction is improperly chewed food that becomes lodged in the airway; the so-called "cafe coronary." Children have a disturbing tendency to swallow foreign objects during play. Another cause occurs during unconsciousness, when the tongue may fall back and block the pharynx (fig. 4-1). Normally, the heart will continue to beat until oxygen deficiency becomes acute. Periodic checks of the carotid artery must be made to ensure that circulation is being maintained.

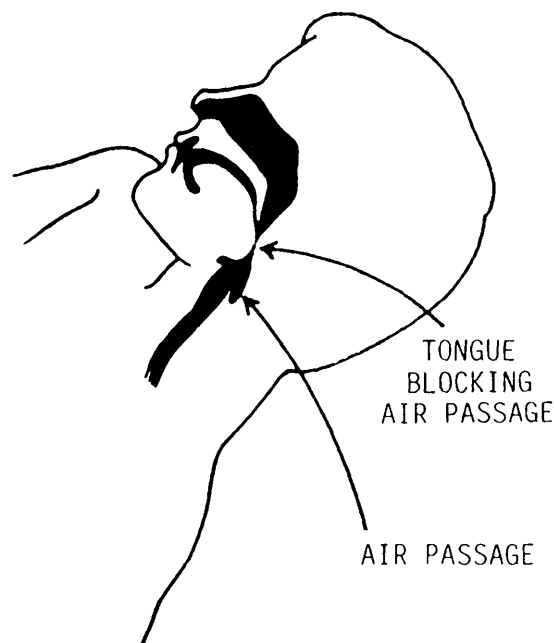


Figure 4-1.—Blocked airway.

### Partial Airway Obstruction

The signs of partial airway obstruction include unusual breath sounds, skin discoloration (cyanosis), or changes in breathing pattern. The conscious patient will usually make clutching motions toward the neck, even when the obstruction does not prevent speech. For the conscious patient with an apparent partial obstruction, encourage him or her to cough. NOTE: In cases where the patient has an apparent partial obstruction but cannot cough, begin to treat the patient as if this were a complete obstruction. This also applies to patients who are cyanotic.

### Complete Airway Obstruction

The conscious patient will attempt to speak but will be unable to do so, nor will he or she be able to cough. Usually, the patient will display the universal distress signal for choking by clutching at the neck. The unconscious patient with a complete airway obstruction exhibits none of the usual signs of breathing: rise and fall of the chest and air exchange through the nose and/or mouth. A complete blockage is also indicated if a perfectly executed attempt to perform artificial ventilation fails to instill air into the lungs.

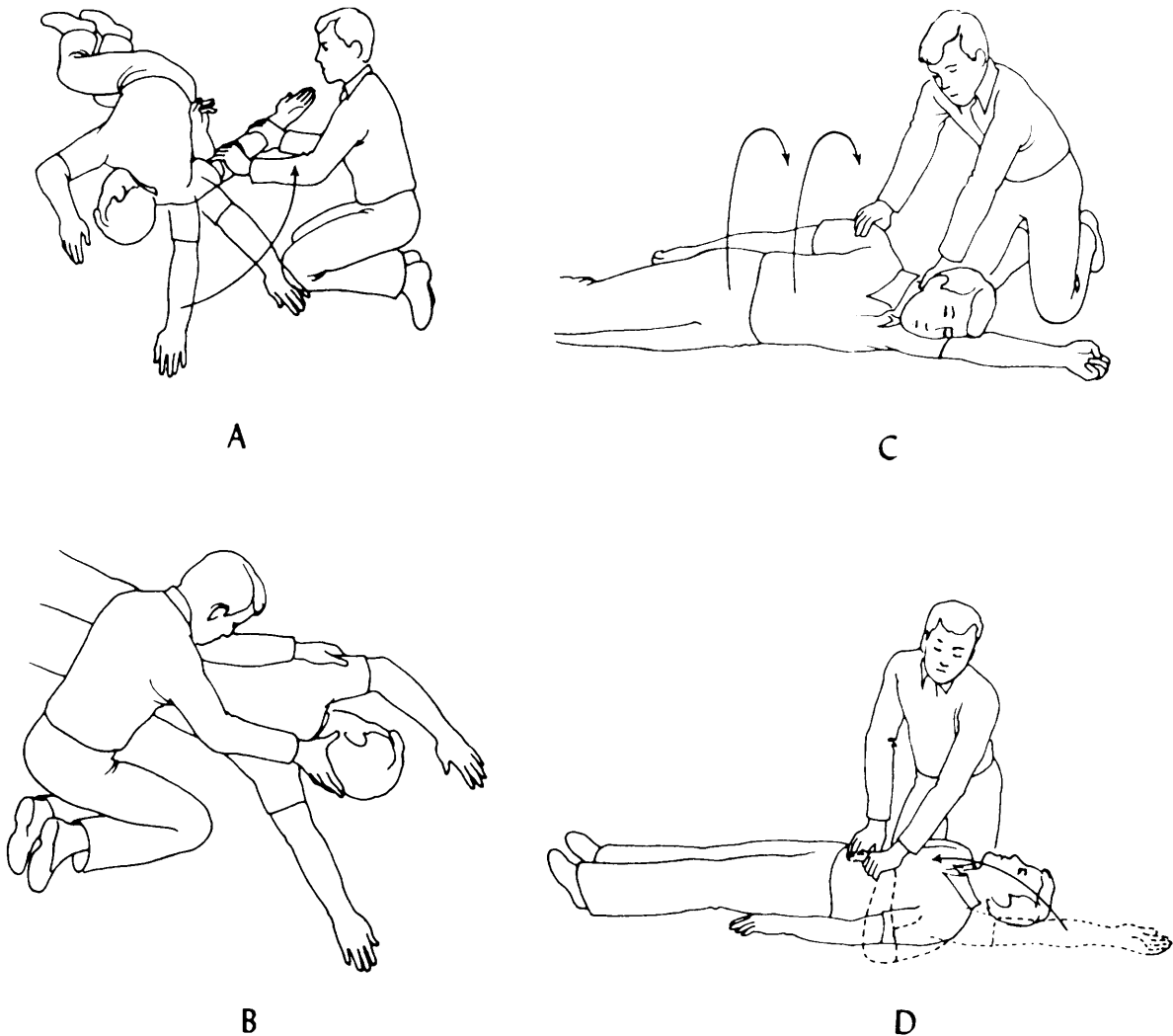


Figure 4-2.—Repositioning the victim of spinal injuries.

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## Opening the Airway

Many problems of airway obstruction, particularly those caused by the tongue, can be corrected simply by repositioning the head and neck. If repositioning does not alleviate the problem, more aggressive measures must be taken. **NOTE:** Before going further, it is imperative that corpsmen remember to check all victims for possible spinal injuries before any repositioning is attempted. If there is no time to immobilize these injuries and the airway cannot be opened with the victim in the present position, then great care must be taken when repositioning. The head, neck, and back must be moved as a single unit. To do this, adhere to the following steps (see figure 4-2).

- Kneel to the side of the victim in line with the victim's shoulders but far enough away so that the victim's body will not touch yours when it is rolled toward you.
- Straighten the victim's legs, gently but quickly.
- Move the victim's closest arm along the floor until it reaches straight out past the head.
- Support the back of the victim's head with one hand while you reach over with the other hand to grab the far shoulder.

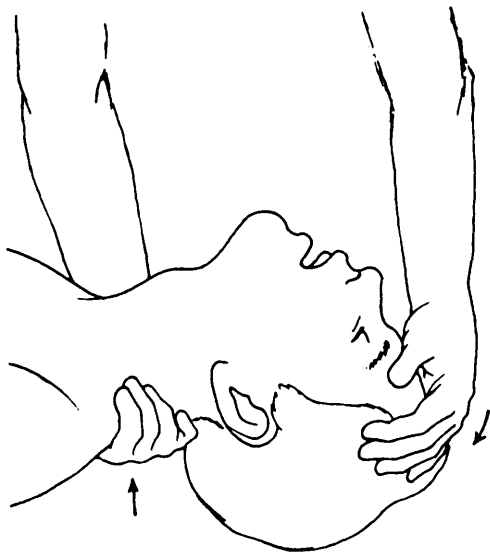


Figure 4-3.—Head tilt.

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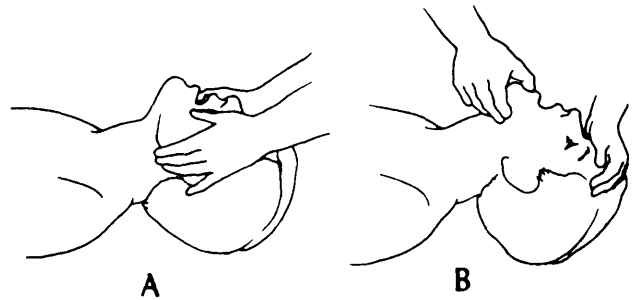


Figure 4-4.—Jaw thrust.

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- Pull the far shoulder toward you while at the same time keeping the head and neck in a natural straight line with the back. The head resting on the extended arm will help you in this critical task.

## Head Tilt

The head tilt technique of opening the airway is a simple repositioning of the head. With the patient lying down, place one of your hands on his or her forehead and apply gentle, firm, backward pressure using the palm of your hand. With your other hand under the victim's neck, lift the neck (fig. 4-3). This will lift the patient's tongue away from the back of the throat and provide an adequate airway. **NOTE:** This technique is not recommended for patients with suspected neck or spinal injuries.

## Jaw thrust

A second technique for opening the airway is the jaw thrust. This technique is accomplished by kneeling by the top of the victim's head and placing your fingers behind the angles of the lower jaw (fig. 4-4A), or hooking your fingers under the jaw (fig. 4-4B), then bringing the jaw forward. Separate the lips with your thumbs to allow breathing through the mouth as well as the nose. This technique is to be used if a neck injury is suspected.

Either the head tilt or the jaw thrust will offer some relief for most forms of airway obstruction. They also prepare the airway for artificial ventilation. If the airway is still seriously obstructed, it may be necessary to try to remove the obstruction by using the abdominal thrust or chest thrust methods indicated for opening a completely blocked airway.

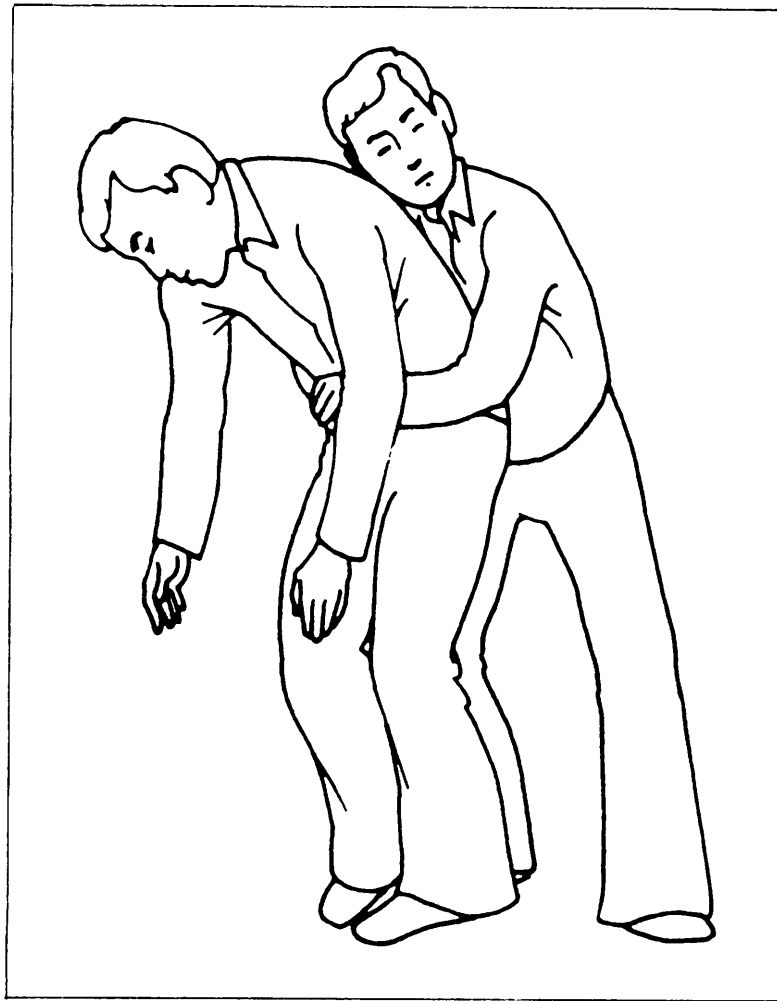


Figure 4-5.—Position for standing abdominal thrust.

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### Abdominal thrusts

The abdominal thrust makes use of the air reserve in the lungs. It is also highly effective in removing water from the lungs of near drowning victims.

**ABDOMINAL THRUST STANDING TECHNIQUE.**— Stand behind the victim and wrap your arms around the victim's waist, as illustrated in figure 4-5. Make a fist with one hand and place it thumbside against the abdomen along the midline and slightly above the navel. Grasp the fist with the other hand (see figure 4-6). Give four quick upward thrusts to the victim. The obstruction should pop out like a champagne cork.

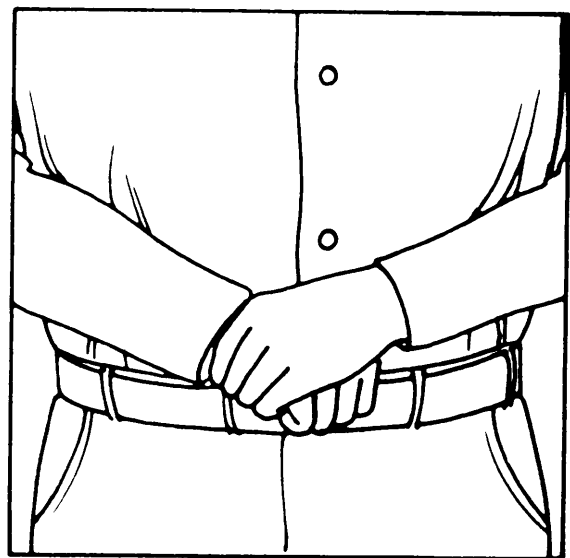


Figure 4-6.—Correct hand position for abdominal thrust.

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**ABDOMINAL THRUST RECLINING TECHNIQUE.**— Position yourself for the thrust

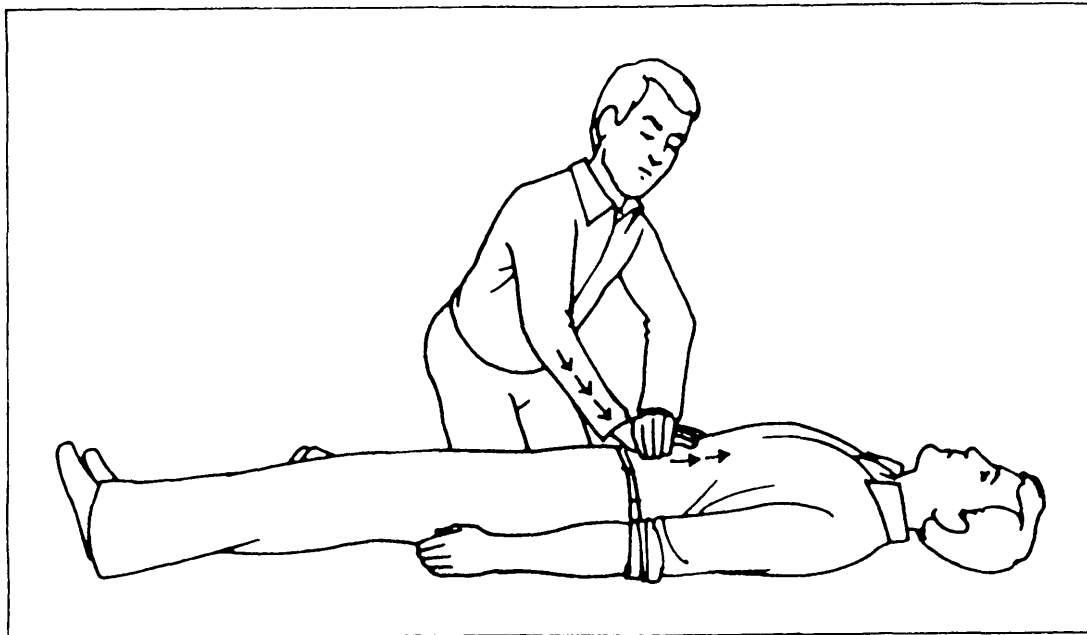


Figure 4-7.—Position for reclining abdominal thrust.

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by straddling the victim at the hips. Place the heels of your hands one on top of the other, along the midline, slightly above the navel, and give four quick upward thrusts into the abdomen, as illustrated in figure 4-7. Note that the victim must be lying face up.

If unsuccessful, repeat the four abdominal thrusts until the obstruction is dislodged.

### Chest Thrusts

For obese or pregnant victims, the chest thrust methods are recommended for removing airway obstructions since manual pressure in the abdomen area of these people would either be ineffective or cause internal damage.

**CHEST THRUST STANDING TECHNIQUE.**— Bring your arms under the arms of the victim, and encircle the lower chest, as shown in figure 4-8. Grasp your wrists, keeping the thumb side close to the victim's chest. Keep your fist on the middle of the sternum, not the lower part. Press the chest with sharp, backward thrusts.



Figure 4-8.—Position for standing chest thrust.

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**CHEST THRUST RECLINING TECHNIQUE.**— Kneel at either side, and place your hands on the chest in exactly the same manner as for external chest compression (fig. 4-9). Give four quick downward thrusts with the arms.

If unsuccessful, repeat the four chest thrusts until the obstruction is dislodged.

## BREATHING

The second aspect of basic life support is to restore breathing in cases of respiratory arrest. Failure of the breathing mechanism maybe caused by various factors. They include complete airway obstruction, insufficient oxygen in the air, the inability of the blood to carry oxygen (carbon monoxide poisoning), paralysis of the breathing center of the brain, and external compression of the body. Breathing failure is usually, but not always, immediately accompanied by cardiac arrest. Periodic checks of the carotid pulse must be made, and you must be prepared to start cardiopulmonary resuscitation (CPR).

The signs of respiratory arrest are an absence of respiratory effort, a lack of detectable air movement through the nose or mouth, unconsciousness, and a cyanotic discoloration of the lips and nail beds.

## Artificial Ventilation

The purpose of artificial ventilation is to provide a method of air exchange until natural breathing is re-established. Artificial ventilation should be given only when natural breathing has been suspended; it must not be given to a person who is breathing naturally. Do not assume that a person's breathing has stopped merely because the person is unconscious or has been rescued from water, from poisonous gas, or from contact with an electric wire. Remember: **DO NOT GIVE ARTIFICIAL VENTILATION TO A PERSON WHO IS BREATHING NATURALLY.** If the victim does not begin spontaneous breathing after using the head tilt or jaw thrust techniques to open the airway, attempt to use artificial ventilation immediately. If ventilation is inadequate, use the thrust techniques to clear the airway, followed by another attempt at artificial ventilation.

## Mouth-to-Mouth

To perform mouth-to-mouth ventilation, place one hand under the victim's neck and place



Figure 4-9.—Position for reclining chest thrust. 136.63

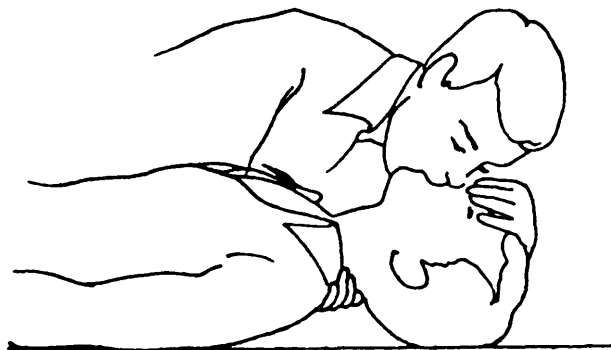
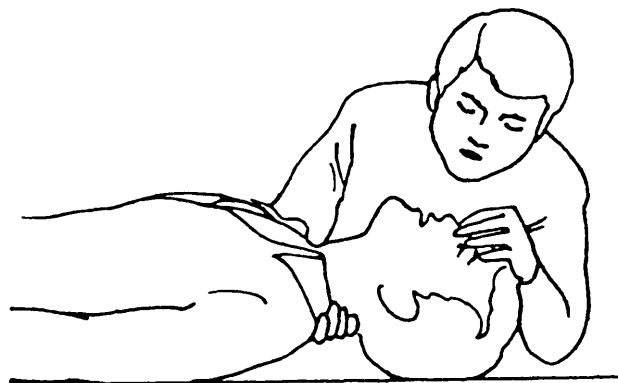


Figure 4-10.—Mouth-to-mouth ventilation. 136.60

the heel of the other hand on the forehead, using the thumb and index finger to pinch the nostrils shut. Tilt the head back to open the airway. If there is no spontaneous breathing, start artificial ventilation with two ventilations, allowing the lungs to deflate. If the victim still does not respond, then you must fully inflate the lungs at the rate of 12 VENTILATIONS PER MINUTE OR ONE BREATH EVERY 5 SECONDS. See figure 4-10 for the proper position. Periodically, check the pupils for reaction to light; constriction is a sign of adequate oxygenation. For infants, seal both the mouth and nose with your mouth. Blow puffs from your cheeks to prevent lung damage. Mouth-to-mouth ventilation can be administered with the jaw thrust.

### Mouth-to-Nose

Mouth-to-nose ventilation is effective when the victim has extensive facial or dental injuries; this permits an effective air seal.

To administer this method, place the heel of one hand on the victim's forehead and use the other hand to lift the jaw. After sealing the victim's lips, start artificial ventilation with two breaths, allowing the lungs to deflate. If the victim does not respond, then you must fully inflate the lungs at the rate of 12 ventilations per minute or one breath every 5 seconds until the victim can breathe spontaneously.

### Back-Pressure Arm-Lift

The back-pressure arm-lift method is a less effective technique used when other methods are not feasible, such as on a battlefield where gas masks must be worn. Place the victim in the prone position, face to one side, and neck hyperextended with the hands under the head. Quickly clear the mouth of any foreign matter. Kneel at the victim's head and place your hands on the back so that the heels of your hands lie just below a line between the armpits, with thumbs touching and fingers extending downward and outward (fig. 4-11). Rock forward, keeping your arms straight and exert pressure almost directly downward on the victim's back, forcing air out of the lungs. Then rock backward, releasing the pressure and grasping the arm just above the elbows. Continue to rock backward, pulling the arms upward and inward (toward the head) until resistance and tension in the shoulders are noted. This expands the chest, causing active intake of air (inspiration). Rock forward and release the victim's arms. This causes passive exiting of air (expiration). Repeat the cycle of press, release, lift, and release 12 times a minute until the victim can breathe spontaneously.

### Mask-to-Mask

Certain types of gas masks for use in a contaminated environment, such as on a battlefield after a chemical or biological warfare attack, are equipped to allow a corpsman to give a victim artificial ventilation without either the corpsman

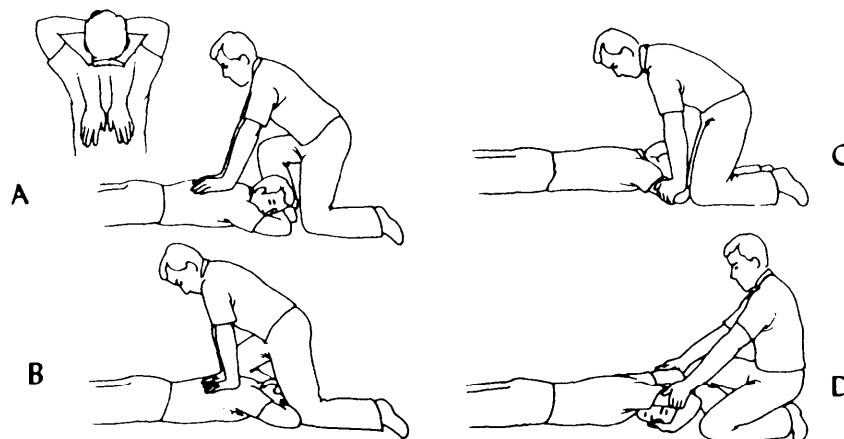


Figure 4-11.—Back pressure arm lift.

154.132

or the patient being exposed to the unhealthy atmosphere. This is carried out by a coupling on the face of each mask. When they are joined, an airway is formed, allowing ventilation to proceed.

### **Gastric Distention**

Sometimes during artificial ventilation, air is forced into the stomach instead of into the lungs. The stomach becomes distended (bulges), indicating that the airway is blocked or partially blocked, or that ventilations are too forceful. This problem is more commonly seen in children but can occur with any patient. A slight bulge is of little worry, but a major distention can cause two serious problems. First is a reduced lung volume; the distended stomach forces the diaphragm up. Second, there is a strong possibility of vomiting.

The best way to avoid gastric distention is to properly position the head and neck and/or limit the volume of ventilations delivered.

**NOTE: THE AMERICAN HEART ASSOCIATION (AHA) STATES THAT NO ATTEMPT SHOULD BE MADE TO FORCE AIR FROM THE STOMACH UNLESS SUCTION EQUIPMENT IS ON HAND FOR IMMEDIATE USE.**

If suction equipment is ready and the patient has a marked distention, you can turn the patient on his or her side facing away from you. With the flat of your hand, apply gentle pressure between the navel and the rib cage. Be prepared to use suction should vomiting occur.

### **SUPPORTIVE EQUIPMENT**

As a corpsman, you should become familiar with various pieces of supportive equipment that may be available to help you to maintain an open airway and to restore breathing in emergency situation. They include artificial airways, the bag-valve-mask system, the mouth-to-mask system with the oxygen-inlet valve, and suction.

#### **Use of Oxygen (O<sub>2</sub>)**

In an emergency first aid situation, the corpsman will probably have a size E, 650-liter cylinder available. This is fitted with a yoke-style pressure reducing regulator, with gauges to show tank pressure and flow rate (adjustable from 0 to 15 liters per minute) A humidifier can be attached to the flowmeter nipple to help prevent tissue

drying caused by the water vapor free oxygen. An oxygen line can be connected from the flowmeter nipple or humidifier to a number of oxygen delivery devices that will be discussed later.

When available, oxygen should be administered, as described below, to cardiac arrest patients and to self-ventilating patients who are unable to inhale enough oxygen to prevent hypoxia (oxygen deficiency). Hypoxia is characterized by tachycardia, nervousness, irritability, and finally cyanosis. It develops in a wide range of situations from poisoning to shock, crushing chest injuries, cerebrospinal accidents, and heart attack.

Oxygen must never be used near open flames since it supports burning. The cylinders must be handled carefully since they are potentially lethal missiles if punctured or broken.

### **Artificial Airways**

The oropharyngeal and nasopharyngeal airways are primarily used to keep the tongue from occluding the airway.

**OROPHARYNGEAL AIRWAY.—** This airway can be used only on unconscious victims because a conscious person will gag on it. They come in various sizes for different age groups (it is important to choose the correct size for the victim), and they are shaped to rest on the contour of the tongue and extend from the lips to the pharynx.

One method of insertion is to depress the tongue with a tongue blade and slide the airway in. Another method is to insert the airway upside down into the victim's mouth; then rotate it 180 degrees as it slides into the pharynx (fig. 4-12).

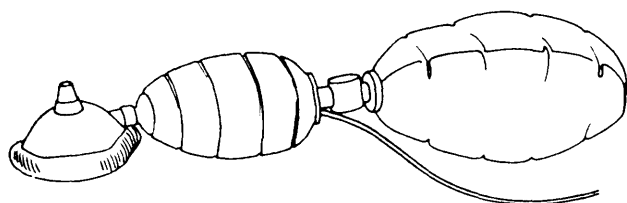
**NASOPHARYNGEAL AIRWAY.—** This airway may be used on conscious victims since it is better tolerated because it generally does not stimulate the gag reflex. Since they are made of flexible material, they are designed to be lubricated and then gently passed up the nostril and down into the pharynx. If the airway meets an obstruction in one nostril, withdraw it and try to pass it up the other nostril.

### **Bag-Valve-Mask System**

The bag-valve-mask system (fig. 4-13) is designed to help ventilate an unconscious victim for long periods, while delivering high concentrations of oxygen. This system can be useful in extended CPR attempts because when using external



154.133  
Figure 4-12.—Placement of an oropharyngeal airway.



154.134  
Figure 4-13.—Bag-valve-mask system.

cardiac compressions, the cardiac output is cut to 25 to 30 percent of the normal capacity and artificial ventilation does not supply enough oxygen through the circulatory system to maintain life for a long period.

Various types of bag-valve-mask systems that come in both adult and pediatric sizes are in use in the Navy. Essentially, they consist of a self-filling ventilation bag, an oxygen reservoir, plastic face masks of various sizes, and tubing for connection to an oxygen supply.

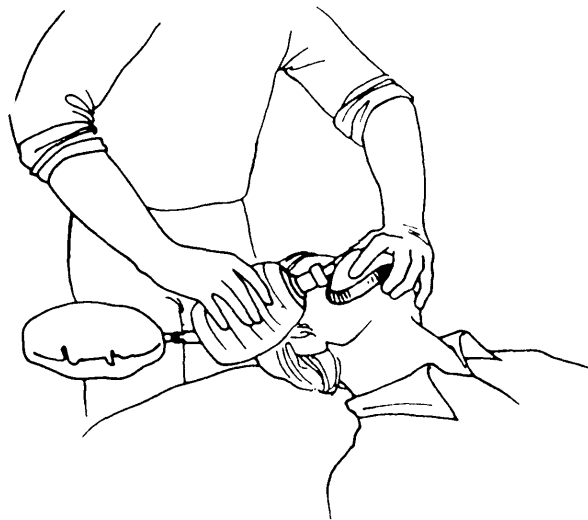
The bag-valve-mask system is difficult to use if the corpsman has not had a great deal of practice with it. It must not be used by inexperienced

persons. The system can be hard to clean and reassemble properly, the bagging hand can tire easily, and an airtight seal at the face is hard to maintain, especially if a single rescuer must also keep the airway open. In addition, the amount of air delivered to the victim is limited to the volume that the hand can displace from the bag (approximately 1 liter per compression).

**TECHNIQUE.**— Hook the bag up to an oxygen supply and adjust the flow from 10 to 15 liters per minute depending on the desired concentration (15 liters per minute will deliver an oxygen concentration of 90 percent). After hyperextending the neck to open airway or inserting an oropharyngeal airway, place the mask over the face and hold it firmly in position with the index finger and thumb, while the remaining fingers keep the jaw tilted upward (fig. 4-14). The other hand is used to compress the bag once every 5 seconds. Observe the chest and abdomen for expansion. If none is observed, the face mask seal may not be airtight, the airway may be blocked, or some component of the bag-valve-mask system may be malfunctioning.

#### Mouth-to-Mask System

A pocket mask designed for mouth-to-mask ventilation, with an oxygen-inlet flow valve, can be used to give oxygen enriched artificial ventilation. Although this system cannot achieve oxygen concentrations as high as the bag-valve-mask



154.135  
Figure 4-14.—Bag-valve-mask system in use.

system, it has the advantages of providing greater air volume (up to 4 liters per breath), and being far easier to use since both hands can be used to maintain the airway and keep the mask firmly in place (fig. 4-15).

**TECHNIQUE.**— Standing behind the head of the victim, open the airway by tilting the head backward. Place the mask over the victim's face (for adults, the apex goes over the bridge of the nose; for infants, the apex fits over the chin, with the base resting on the bridge of the nose). Form an airtight seal for the mask and keep the airway open by pressing down on the mask with both thumbs while using the other fingers to lift the jaw up and back. The corpsman then ventilates into the open chimney of the mask.

Oxygen can be added by hooking the valve up to an oxygen supply. Since the oxygen flow will be diluted by the rescuer's breath in artificial ventilation, the flow rate will have to be adjusted to increase oxygen concentration. At 5 liters per minute, the oxygen concentration will be approximately 50 percent. At 15 liters per minute, this will increase to 55 percent.

The mask has an elastic strap so it can be used on conscious self-ventilating patients to increase oxygen concentration.

### Esophageal Obturator Airway (EOA)

An EOA is a semi-flexible large-bore tube approximately 30 cm in length, with 19 holes in the shaft and an inflatable cuff. A soft face mask is attached to one end and the other end is closed. The airway was designed for personnel who are not authorized to place endotracheal tubes. One of the distinct advantages is that it can be inserted blindly through the mouth without having to visualize the larynx. It is also helpful in the prevention of gastric regurgitation. The disadvantages are that the tracheo-bronchial tree cannot be adequately suctioned and there is the possibility of esophageal rupture when the cuff is inflated too fully.

The following steps are to be followed when inserting the EOA:

1. Hyperventilate the patient.
2. Position the head in a neutral position or slightly flexed. DO NOT hyperextend the neck.
3. Lift the jaw as in figure 4-16A.
4. Insert the tube until the mask is flush with the face as in figure 4-16B.



Figure 4-15.—Mouth-to-mask breathing.

5. Ventilate through the tube and auscultate both lung fields. The EOA is sometimes inserted into the trachea; this is of little worry if recognized and corrected immediately.
6. Inflate the cuff (about 35cc of air). Overinflation can possibly rupture the esophagus or may compress the trachea causing an obstruction.
7. Ventilate and auscultate again to ensure proper placement.

### Cricothyroidotomy

A cricothyroidotomy, often known as an emergency tracheotomy, consists of incising the cricothyroid membrane, which lies just beneath the skin between the thyroid cartilage and the cricoid cartilage. The cricothyroid membrane can be located easily in most cases. Hyperextend the neck so that the thyroid notch (Adam's apple) becomes prominent anteriorly. Identify the position of the thyroid notch with the index finger. This finger descends in the midline to the prominence of the cricoid cartilage. The depression of the cricothyroid membrane is identified above the superior margin of the cricoid cartilage (fig. 4-17). A small lateral incision is made at the base of the thyroid cartilage to expose the cricothyroid membrane. This membrane is then excised, taking

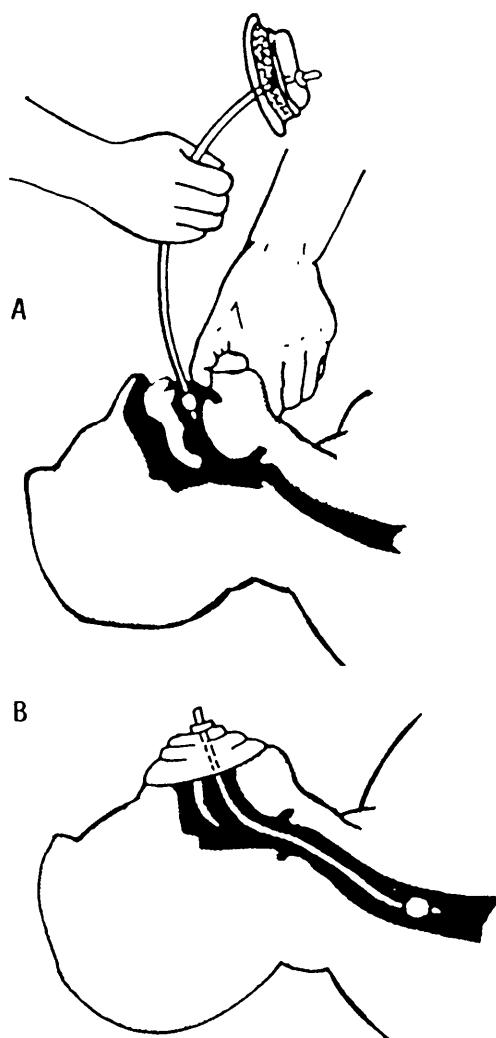


Figure 4-16.—Insertion of esophageal obturator airway.

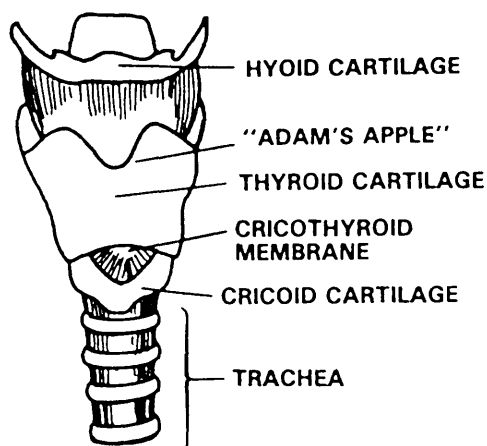


Figure 4-17.—Structure of the neck to identify cricothyroid membrane.

care not to go too deeply, and a small bore airline is then inserted into the trachea.

An alternate method is to use a 12 to 16 gauge intercatheter. Locate the cricothyroid membrane as above and insert the needle into the trachea. Immediately upon penetrating the cricothyroid membrane, thread the plastic catheter into the trachea and remove the needle. The catheter can then be connected to an oxygen line for translaryngeal oxygen jet insufflation.

A cricothyroidotomy should not be attempted except as a last resort when other methods of opening the airway are unsuccessful.

### Suctioning Devices

In a first aid setting, the hospital corpsman may have access to portable or fixed suctioning devices equipped with flexible tubing, semirigid tips, suction catheters, and nonbreakable collection bottles. The suction pressure should be tested regularly and the equipment kept clean.

**TECHNIQUE.**—After testing the apparatus, attach a catheter or tip, and open the victim's mouth. Carefully insert the end into the pharynx. Apply suction, but for no more than 15 seconds. Suction may be repeated after a few breaths.

### CIRCULATION

Cardiac arrest is the complete stoppage of heart function. If the victim is to live, action must be taken immediately to restore heart function. The symptoms include absence of carotid pulse, lack of heartbeat, dilated pupils, and absence of breathing.

A rescuer knowing how to administer cardiopulmonary resuscitation (CPR) greatly increases the chances of a victim's survival. CPR consists of external heart compression and artificial ventilation. This compression is performed on the outside of the chest, and the lungs are ventilated by the mouth-to-mouth or mouth-to-nose techniques. To be effective, CPR must be started within 4 minutes of the onset of cardiac arrest. The victim should be supine on a firm surface.

CPR should not be attempted by a rescuer who has not been properly trained. If improperly done, CPR can cause serious damage. It must never be practiced on a healthy individual for training purposes; use a training aid instead. To learn this technique, see your medical education department or an American Heart Association or

American Red Cross certified corpsman, nurse, or physician.

## One Rescuer Technique

The rescuer must not assume that an arrest has occurred solely because the victim is lying on the floor and appears to be unconscious. First, try to arouse the victim by gently shaking the shoulders and trying to obtain a response; (loudly ask: "Are you O.K.?"). If there is no response, place the victim supine on a firm surface. Kneel at a right angle to the victim, and open the airway using the head tilt or jaw thrust methods described previously. Attempt to ventilate. If unsuccessful, reposition the head and again attempt to ventilate. If still unsuccessful, deliver four abdominal or chest thrusts to open the airway. Repeat the thrust sequence until the obstruction is removed.

Once the airway has been opened, check for the carotid pulse. The carotid artery is most easily found by locating the larynx at the front of the neck and then sliding two fingers down the side of the neck toward you. The carotid pulse is felt in the groove between the larynx and the sternocleidomastoid muscle. If the pulse is present, ventilate as necessary. If the pulse is absent, locate the sternum and begin closed cardiac massage.

To locate the sternum, use the middle and index fingers of your lower hand to locate the lower margin of the victim's rib cage on the side closest to you (fig. 4-18A). The fingers are then moved up along the edge of the rib cage to the notch where the ribs meet the sternum in the center of the lower chest (fig. 4-18B). The middle finger is placed on the notch and the index finger is placed next to it. The heel of the other hand is placed along the midline of the sternum next to the index finger (fig. 4-18C). Remember to keep the heel of your hand off the xiphoid tip of the sternum. A fracture in this area can damage the liver, causing hemorrhage and death.

Place the heel of one hand directly on the sternum and the heel of the other on top of the first (fig. 4-18D). Interlock your fingers or extend them straight out and **KEEP THEM OFF THE VICTIM'S CHEST!**

Lean or rock forward with the elbows locked and apply vertical pressure to depress the sternum (adult) 1 1/2 to 2 inches. Then release the pressure, keeping the hands in place on the chest.

You will feel less fatigue if you use the proper technique and a more effective compression will result. Ineffective compression occurs when the elbows are not locked, the rescuer is not directly over the sternum, or the hands are improperly placed on the sternum.

When one rescuer performs CPR, as shown in figure 4-19, the ratio of compressions to ventilation is 15 to 2, and it is performed at a rate of 80 compressions per minute to maintain 60 full compression each minute. Vocalize: "one and, two and, three and, . . ." until you reach 15. After 15 compressions, you must give the victim 2 ventilation. Continue for four full cycles. Quickly check for the carotid pulse and spontaneous breathing. If there are still no signs of recovery, continue CPR. If a periodic check reveals a return of pulse and respiration, discontinue CPR, but closely monitor the victim and be prepared to start CPR again if required.

Before learning the next technique, review the steps to take for a cardiac arrest involving one rescuer.

1. Determine whether the victim is conscious.
2. Check vital signs.
3. Ventilate two times (it may be necessary to remove an airway obstruction at this time).
4. Again check vital signs; if there are none, begin the compression-ventilation rate of 15 to 2 for four complete cycles.
5. Check pulse, breathing, and pupils; if there is no change, continue the compression-ventilation rate of 15 to 2 until the victim is responsive, you are properly relieved, or you can no longer continue.

## Two Rescuer Technique

If there are two people trained in CPR on the scene, one must perform compression while the

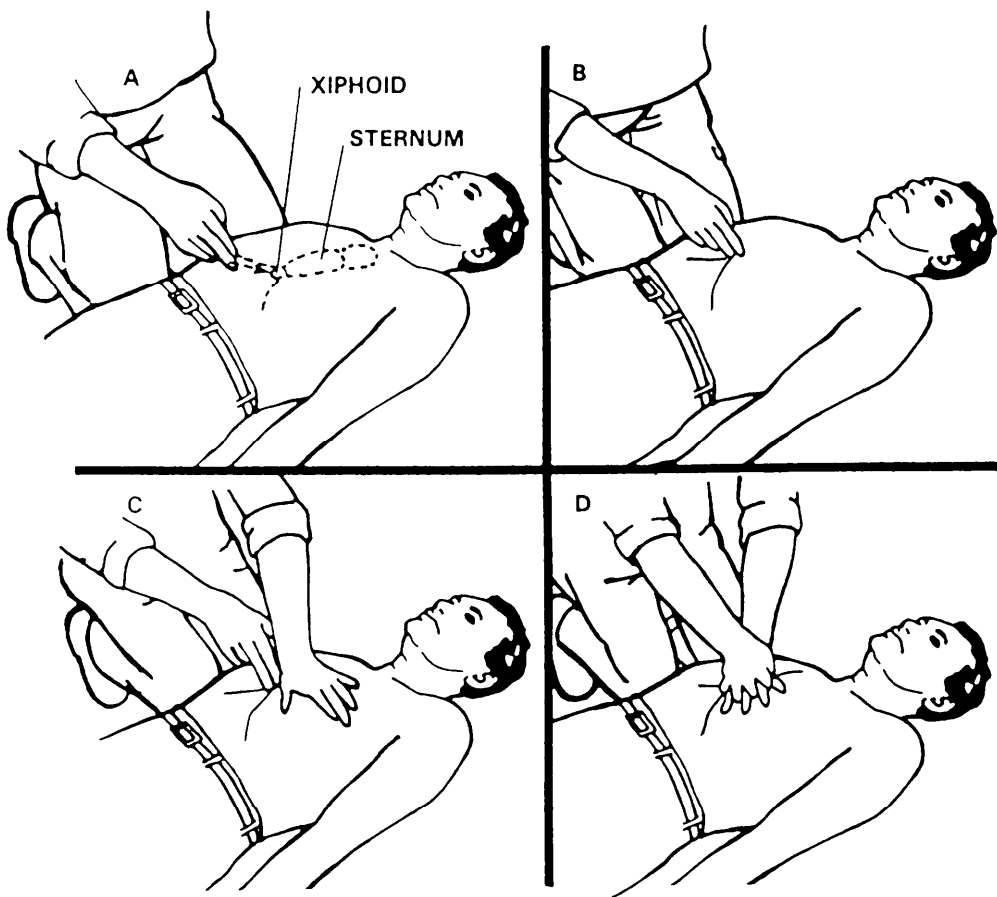


Figure 4-18.—Locating the sternum for closed cardiac massage.



Figure 4-19.—One-rescuer CPR technique.

other performs ventilation (fig. 4-20). The ratio for the two person CPR is 5 compressions to 1 ventilation, at a rate of 80 compressions per minute. One rescuer is positioned at the chest area and the other beside the victim's head. The rescuers should be on opposite sides of the victim to ease position changes when one rescuer gets tired. Changes should be made on cue without interrupting the rhythm.

To help avoid confusion, one rescuer must be designated the leader. The leader must make the preliminary checks of the victim's vital signs and perform the initial 2 ventilations. The second rescuer will get ready for compression and perform the compressions.

When CPR is started, give the compression in a constant, methodical rhythm. The rescuer giving the compressions counts them out loud (one one thousand, two one thousand, three one thousand, four one thousand, five one thousand). As the fifth compression is released, the other rescuer ventilates the victim. Allow a short pause to ventilate the victim.

### **CPR for Children and Infants**

Closed chest cardiac massage for children is similar to that for adults. The primary difference is that the heel of only one hand is used to depress the middle of the sternum from  $\frac{3}{4}$  to  $1\frac{1}{2}$  inches. The other hand can be used to maintain a head tilt that helps ventilation. For infants, only two fingers are used to depress the middle of the sternum from  $\frac{1}{2}$  to  $\frac{3}{4}$  of an inch. For both infants and children, the compression rate increases from 80 to 100 compressions per minute.

The head-tilt or jaw thrust methods of ensuring an open airway will cause the upper back of an infant or small child to arch upward. Additional support for the back is provided by a folded towel, sheet, or blanket.

### **SOFT TISSUE INJURIES**

The most common injuries seen by the corpsman in a first aid setting are soft tissue injuries with the accompanying hemorrhage, shock, and danger of infection. Any injury that causes a break in the skin, underlying soft tissue structures, or body membranes is known as a WOUND. This section will discuss the classification of wounds, the general and specific treatment of soft tissue injuries, the use of dressings and bandages in treating wounds, and the special problems that arise because of the location of wounds.



154.137  
Figure 4-20.—Two-rescuer CPR technique.

### **CLASSIFICATION OF WOUNDS**

Wounds may be classified according to their general condition, size, location, the manner in which the skin or tissue is broken, and the agent that caused the wound. It is usually necessary for you to consider these factors to determine what first aid treatment is appropriate for the wound.

#### **General Condition of the Wound**

If the wound is fresh, first aid treatment consists mainly of stopping the flow of blood, treating for shock, and reducing the risk of infection. If the wound is already infected, first aid consists of keeping the victim quiet, elevating the injured part, and applying a warm wet dressing. If the wound contains foreign objects, first aid treatment may consist of removing the objects if they are not deeply embedded. **DO NOT** remove objects embedded in the eyes or the skull, and do not remove impaled objects. Impaled objects must be stabilized with bulky dressing before transport.

## Size of the Wound

In general, since large wounds are more serious than small ones, they usually involve more severe bleeding, more damage to the underlying organs or tissues, and a greater degree of shock. However, small wounds are sometimes more dangerous than large ones; they may become infected more readily due to neglect. The depth of the wound is also important because it may lead to a complete perforation of an organ or the body, with the additional complication of entrance and exit wounds.

## Location of the Wound

Since a wound may involve serious damage to the deeper structures, as well as to the skin and the tissue immediately below it, the location of the wound is important. For example, a knife wound to the chest may puncture a lung and cause interference with breathing. The same type of wound in the abdomen may result in a dangerous infection in the abdominal cavity, or it might puncture the intestines, liver, kidneys, or other vital organs. A knife wound to the head may cause brain damage, but the same wound in a less vital spot such as an arm or leg might be less important.

## Types of Wounds

When you consider the manner in which the skin or tissue is broken, there are six general kinds of wounds: abrasions, incisions, lacerations, punctures, avulsions, and amputations. Many wounds, of course, are combinations of two or more of these basic types.

**ABRASIONS.**— Abrasions are made when the skin is rubbed or scraped off. Rope burns, floor burns, and skinned knees or elbows are common examples of abrasions. This kind of wound can become infected quite easily because dirt and germs are usually embedded in the tissues.

**INCISIONS.**— Incisions, commonly called CUTS, are wounds made by sharp cutting instruments such as knives, razors, and broken glass. Incisions tend to bleed freely because the blood vessels are cut cleanly and without ragged edges. There is little damage to the surrounding tissues. Of all classes of wounds, incisions are the least likely to become infected, since the free flow of blood washes out many of the microorganisms (germs) that cause infection.

**LACERATIONS.**— These wounds are torn, rather than cut. They have ragged, irregular edges and masses of torn tissue underneath. These wounds are usually made by blunt, rather than sharp, objects. A wound made by a dull knife, for instance, is more likely to be a laceration than an incision. Bomb fragments often cause laceration. Many of the wounds caused by accidents with machinery are lacerations; they are often complicated by crushing of the tissues as well. Lacerations are frequently contaminated with dirt, grease, or other material that is ground into the tissue; they are therefore very likely to become infected.

**PUNCTURES.**— Punctures are caused by objects that penetrate into the tissues while leaving a small surface opening. Wounds made by nails, needles, wire, and bullets are usually punctures. As a rule, small puncture wounds do not bleed freely; however, large puncture wounds may cause severe internal bleeding. The possibility of infection is great in all puncture wounds, especially if the penetrating object has tetanus bacteria on it. To prevent anaerobic infections, primary closures are not made in the case of puncture wounds.

**AVULSIONS.**— An avulsion is the tearing away of tissue from a body part. Bleeding is usually heavy. In certain situations, the torn tissue may be surgically reattached. It can be saved for medical evaluation by wrapping it in a sterile dressing and placing it in a cool container, and rushing it, along with the victim, to a medical facility. Do not allow the avulsed portion to freeze and do not immerse it in water or saline.

**AMPUTATIONS.**— A traumatic amputation is the nonsurgical removal of the limb from the body. Bleeding is heavy and requires a tourniquet, which will be discussed later, to stop the flow. Shock is certain to develop in these cases. As with avulsed tissue, wrap the limb in sterile dressings, place it in a cool container, and transport it to the hospital with the victim. Do not allow the limb to be in direct contact with ice, and do not immerse it in water or saline. The limb can often be successfully reattached.

## Causes of the Wound

Although it is not always necessary to know what agent or object has caused the wound, it is helpful. Knowing what has caused the wound may give you some idea of the probable size of the

wound, its general nature, the extent to which it is likely to become contaminated with foreign matter, and what special dangers must be guarded against. Of special concern in a wartime setting is the velocity of wound causing missiles (bullets or shrapnel). A low velocity missile damages only the tissues it comes into contact with. On the other hand, a high velocity missile can do enormous damage by forcing the tissues and body parts away from the track of the missile with a velocity only slightly less than that of the missile itself. These tissues, especially bone, may become damage-causing missiles themselves, thus accentuating the destructive effects of the missile.

Having classified the wound into one or more of the general categories listed, the corpsman will have a good idea of the nature and extent of the injury, along with any special complications. This information will aid in the treatment of the victim.

### **MANAGEMENT OF OPEN SOFT TISSUE INJURY**

There are three basic rules to be followed in the treatment of practically all open soft tissue injuries: to control hemorrhage, to treat the victim for shock, and to do whatever you can to prevent infection. These will be discussed, along with the proper application of first aid materials and other specific first aid techniques.

#### **Hemorrhage**

Hemorrhage is the escape of blood from the vessels of the circulatory system. The average adult body contains about 6 liters of blood. Five hundred milliliters of blood, the amount given by blood donors, can usually be lost without any harmful effect. The loss of 1 liter of blood usually causes shock, but shock may develop if small amounts of blood are lost rapidly, since the circulatory system does not have enough time to compensate adequately. The degree of shock progressively increases as greater amounts of blood escape. Young children, sick people, or the elderly may be especially susceptible to the loss of even small amounts of blood since their internal systems are in such delicate balance.

Capillary blood is usually brick red in color. If capillaries are cut, the blood oozes out slowly. Blood from the veins is dark red. Venous bleeding is characterized by a steady, even flow. If an artery near the surface is cut, the blood, which is bright red in color, will gush out in spurts that are synchronized with the heartbeats. If the severed artery is deeply buried, however, the bleeding will appear to be a steady stream.

In actual practice, you might find it difficult to decide whether bleeding is venous or arterial, but the distinction is not usually important. The important thing to know is that all bleeding must be controlled as quickly as possible.

External hemorrhage is of greatest importance to the corpsman because it is the most frequently encountered and the easiest to control. It is characterized by a break in the skin and visible bleeding. Internal hemorrhage, which will be discussed later, is far more difficult to recognize and to control.

#### **Control of Hemorrhage**

The best way to control external bleeding is by applying a compress to the wound and exerting pressure directly to the wound. If direct pressure does not stop the bleeding, pressure can also be applied at an appropriate pressure point. At times, elevation of an extremity is also helpful in controlling hemorrhage. The use of splints in conjunction with direct pressure can be beneficial. In those rare cases where bleeding cannot be controlled by any of these methods, you must use a tourniquet.

If bleeding does not stop after a short period, try placing another compress or dressing over the first and securing it firmly in place. If bleeding still will not stop, try applying direct pressure with your hand over the compress or dressing.

Remember that in cases of severe hemorrhage, do not worry too much about finding appropriate materials or about the dangers of infection. The basic problem is to stop rapid exsanguination. If no material is available, simply thrust your hand into the wound. In most situations, direct pressure is the first and best method to use in the control of hemorrhage.

#### **Pressure Points**

Bleeding can often be temporarily controlled by applying hand pressure to the appropriate pressure point. A pressure point is a place where the main artery to the injured part lies near the skin surface and over a bone. Apply pressure at this point with the fingers (digital pressure) or with the heel of the hand; no first aid materials are required. The object of the pressure is to compress the artery against the bone, thus shutting off the flow of blood from the heart to the wound.

There are 11 principal points on each side of the body where hand or finger pressure can be used to stop hemorrhage. These points are shown in figure 4-21. If bleeding occurs on the face below

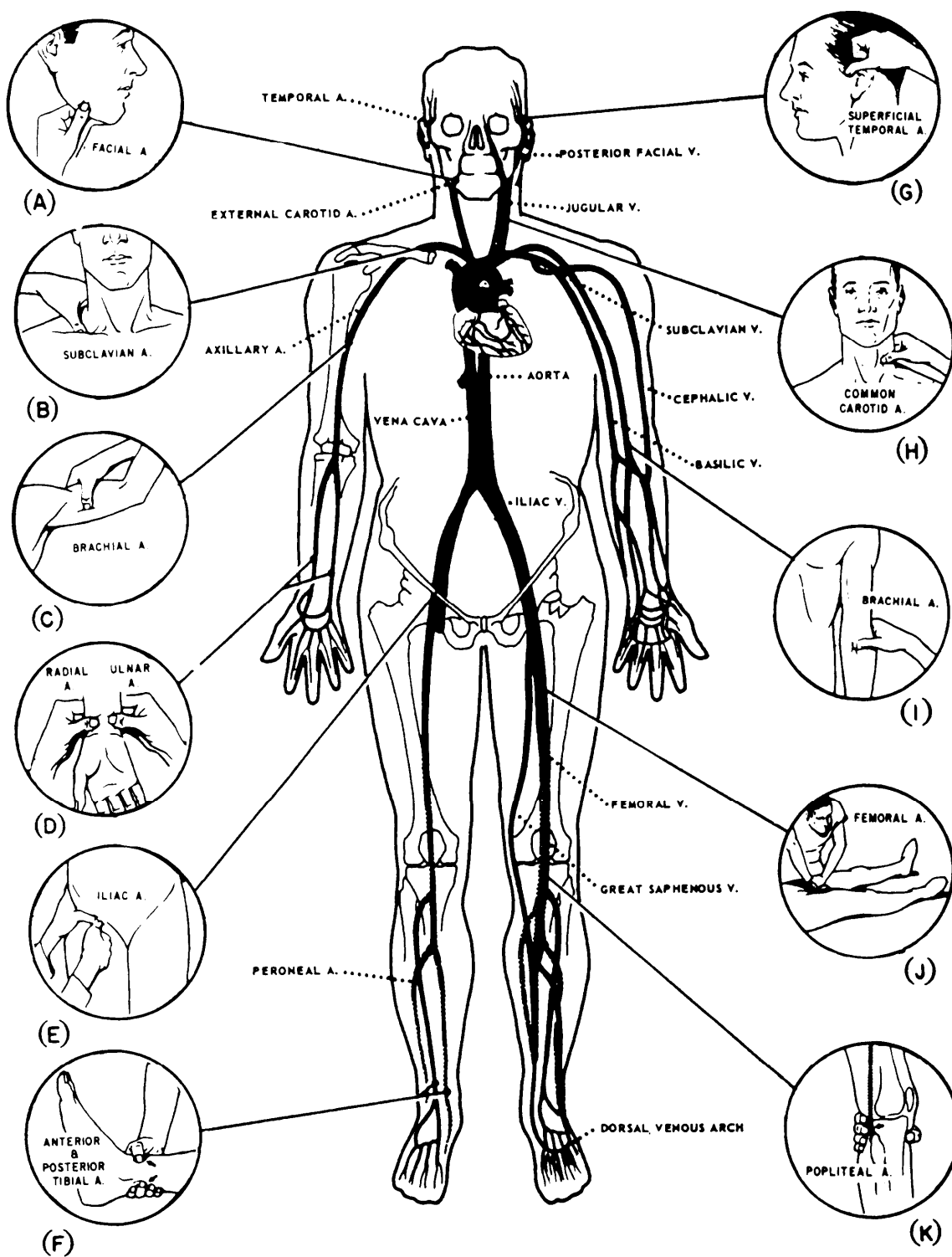


Figure 4-21.—Pressure points.

the level of the eyes, apply pressure to the point on the mandible. This is shown in figure 4-21A. To find this pressure point, start at the angle of the jaw and run your finger forward along the lower edge of the mandible until you feel a small notch. The pressure point is in this notch.

If bleeding is in the shoulder or in the upper part of the arm, apply pressure with the fingers behind the clavicle. You can press down against the first rib or forward against the clavicle—either kind of pressure will stop the bleeding. This pressure point is shown in figure 4-21B.

Bleeding between the middle of the upper arm and the elbow should be controlled by applying digital pressure in the inner (body) side of the arm, about halfway between the shoulder and the elbow. This compresses the artery against the bone of the arm. The application of pressure at this point is shown in figure 4-21C. Bleeding from the hand can be controlled by pressure at the wrist, as shown in figure 4-21D. If it is possible to hold the arm up in the air, the bleeding will be relatively easy to stop.

Figure 4-21E shows how to apply digital pressure in the middle of the groin to control bleeding from the thigh. The artery at this point lies over a bone and quite close to the surface, so pressure with your fingers may be sufficient to stop the bleeding.

Figure 4-21F shows the proper position for controlling bleeding from the foot. As in the case of bleeding from the hand, elevation is helpful in controlling the bleeding.

If bleeding is in the region of the temple or the scalp, use your finger to compress the main artery to the temple against the skull bone at the pressure point just in front of the ear. Figure 4-21 G shows the proper position.

If the neck is bleeding, apply pressure below the wound, just in front of the prominent neck muscle. Press inward and slightly backward, compressing the main artery of that side of the neck against the bones of the spinal column. The application of pressure at this point is shown in figure 4-21 H. Do not apply pressure at this point unless it is absolutely essential, since there is a great danger of pressing on the windpipe and thus choking the victim.

Bleeding from the lower arm can be controlled by applying pressure at the elbow, as shown in figure 4-21I.

As mentioned before, bleeding in the upper part of the thigh can sometimes be controlled by applying digital pressure in the middle of the groin, as shown in figure 4-21E. Sometimes,

however, it is more effective to use the pressure point of the upper thigh, as shown in figure 4-21J. If you use this point, apply pressure with the closed fist of one hand and use the other hand to give additional pressure. The artery at this point is deeply buried in some of the heaviest muscle of the body, so a great deal of pressure must be exerted to compress the artery against the bone.

Bleeding between the knee and the foot may be controlled by firm pressure at the knee. If pressure at the side of the knee does not stop the bleeding, hold the front of the knee with one hand and thrust your fist hard against the artery behind the knee, as shown in figure 4-21K. If necessary, you can place a folded compress or bandage behind the knee, bend the leg back, and hold it in place by a firm bandage. This is a most effective way of controlling bleeding, but it is so uncomfortable for the victim that it should be used only as a last resort.

You should memorize these pressure points so that you will know immediately which point to use for controlling hemorrhage from a particular part of the body. Remember, the correct pressure point is that which is (1) NEAREST THE WOUND, and (2) BETWEEN THE WOUND AND THE MAIN PART OF THE BODY.

It is very tiring to apply digital pressure, and it can seldom be maintained for more than 15 minutes. Pressure points are recommended for use while direct pressure is being applied to a serious wound by a second rescuer, or after a compress, bandage, or dressing has been applied to the wound, since it will slow the flow of blood to the area, thus giving the direct pressure technique a better chance to stop the hemorrhage. It is also recommended as a stopgap measure until a pressure dressing or a tourniquet can be applied.

### Elevation

The elevation of an extremity, where appropriate, can be an effective aid in hemorrhage control when used in conjunction with other methods of control, especially direct pressure. This is because the amount of blood entering the extremity is decreased by the uphill gravitational effect. Do not elevate an extremity until it is certain that no bones have been broken or until broken bones are properly splinted.

Another effective method of hemorrhage control in cases of bone fractures is splinting. The

immobilization of sharp bone ends reduces further tissue trauma and allows lacerated blood vessels to clot. In addition, the gentle pressure exerted by the splint helps the clotting process by giving additional support to compresses or dressings already in place over open fracture sites.

Later in this chapter we will go into the subject of splinting in greater detail.

### Tourniquet

A tourniquet is a constricting band that is used to cut off the supply of blood to an injured limb. Use a tourniquet only if the control of hemorrhage by other means proves to be difficult or impossible. A tourniquet must always be applied ABOVE the wound, i.e., towards the trunk, and it must be applied as close to the wound as practical.

Basically, a tourniquet consists of a pad, a band, and a device for tightening the band so that the blood vessels will be compressed. It is best to use a pad, compress, or similar pressure object, if one is available. It goes under the band. It must be placed directly over the artery or it will actually decrease the pressure on the artery and thus allow a greater flow of blood. If a tourniquet placed over a pressure object does not stop the bleeding, there is a good chance that the pressure object is in the wrong place. If this occurs, shift the object around until the tourniquet, when tightened, will control the bleeding. Any long flat material may be used as the band. It is important that the band be flat: belts, stockings, flat strips of rubber, or neckerchief maybe used; but rope, wire, string, or very narrow pieces of cloth should not be used because they cut into the flesh. A short stick may be used to twist the band, tightening the tourniquet. Figure 4-22 shows how to apply a tourniquet.

To be effective, a tourniquet must be tight enough to stop the arterial blood flow to the limb, so be sure to draw the tourniquet tight enough to stop the bleeding. However, do not make it any tighter than necessary.

After you have brought the bleeding under control with the tourniquet, apply a sterile compress or dressing to the wound and fasten it in position with a bandage.

Here are the points to remember about using a tourniquet:

1. Don't use a tourniquet unless you can't control the bleeding by any other means.
2. Don't use a tourniquet for bleeding from the head, face, neck, or trunk. Use it only on the limbs.

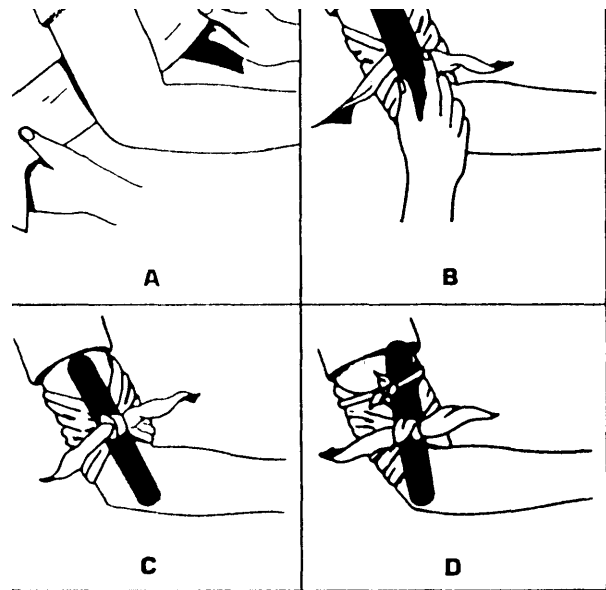


Figure 4-22.—Applying a tourniquet.

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3. Always apply a tourniquet ABOVE THE WOUND and as close to the wound as possible. As a general rule, do not place a tourniquet below the knee or elbow except for complete amputations. In certain distal areas of the extremities, nerves lie close to the skin and may be damaged by the compression. Furthermore, rarely does one encounter bleeding distal to the knee or elbow that requires a tourniquet.
4. Be sure you draw the tourniquet tight enough to stop the bleeding, but don't make it any tighter than necessary. The pulse beyond the tourniquet should disappear.
5. Don't loosen a tourniquet after it has been applied. Transport the victim to a medical facility that can offer proper care.
6. Don't cover a tourniquet with a dressing. If it is necessary to cover the injured person in some way, MAKE SURE that all the other people concerned with the case know about the tourniquet. Using crayon, skin pencil, or blood, mark a large "T" on the victim's forehead or on a medical tag attached to the wrist.

## MANAGEMENT OF SOFT TISSUE INJURY

Internal soft tissue injuries may result from deep wounds, blunt trauma, blast exposure, crushing accidents, bone fracture, poison, or sickness. They may range in seriousness from a simple contusion to life-threatening hemorrhage and shock.

Visible indications of internal soft tissue injury include the following:

1. Hematemesis - vomiting bright red blood.
2. Hemoptysis - coughing up bright red blood.
3. Melena - excretion of tarry black stools.
4. Hematochezia - excretion of bright red blood from the rectum.
5. Hematuria - pass blood in the urine.
6. Nonmenstrual vaginal bleeding.
7. Epistaxis - nosebleed.
8. Pooling of the blood near the skin surface.

More often than not, however, there will be no visible signs of injury, and the corpsman will have to infer the probability of internal soft tissue injury from other symptoms that include:

1. Pale, moist, clammy skin.
2. Subnormal temperature.
3. Rapid, feeble pulse.
4. Falling blood pressure.
5. Dilated, slowly reacting pupils with impaired vision.
6. Tinnitus.
7. Syncope.
8. Dehydration and thirst.
9. Yawning and air hunger.
10. Anxiety, with a feeling of impending doom.

There is little that a corpsman can do to correct internal soft tissue injuries since they are almost always surgical problems. The hospital corpsman's goal must be to obtain the greatest benefit from the victim's remaining blood supply. The following should be done:

1. Treat for shock.
2. Keep the victim warm and at rest.
3. Replace lost fluids with a suitable blood volume expander (refer to the "Intravenous Therapy" section of the *Nursing Procedures Manual*); **DO NOT** give the victim anything to drink until the extent of the injury is known for certain.

4. Give oxygen, if available.
5. Splint injured extremities.
6. Apply cold compresses to identifiable injured areas.
7. Transport the victim to a medical treatment facility as soon as possible.

## Dressings and Bandages

A dressing is a pad or bolster of folded linen that is placed in direct contact with the wound. It should be large enough to cover the entire area of the wound and to extend at least 1 inch in every direction beyond the edges. If the dressing is not large enough, the edges of the wound are almost certain to become contaminated.

In most situations, a corpsman will have sterile, prepackaged dressings available. However, emergencies will sometimes arise when they will be impossible to obtain, or the supplies will run out. In such a situation, use the cleanest cloth available. A freshly laundered handkerchief, towel, or shirt may be used. Unfold these material carefully so that you do not touch the part that goes next to the skin. Always be ready to improvise, but never put materials directly in contact

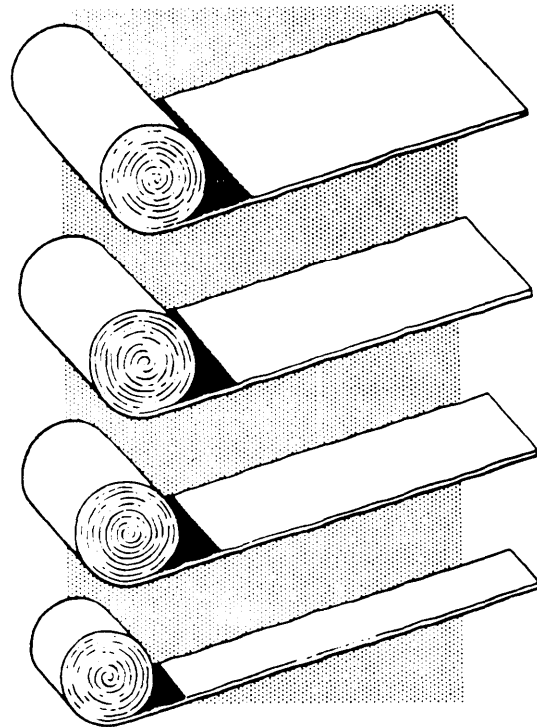
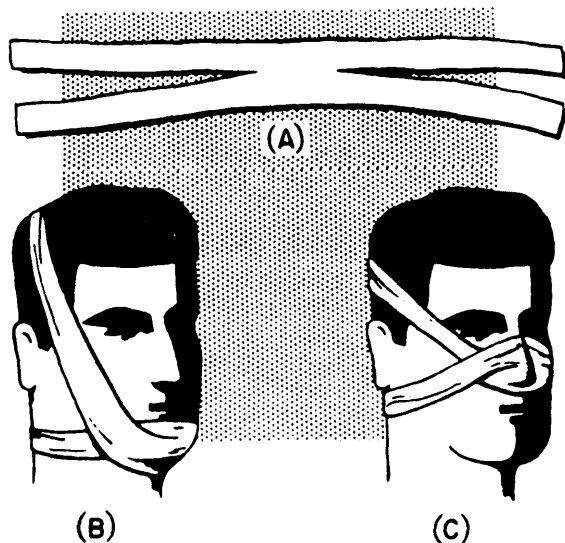


Figure 4-23.—Roller bandages.

136.16



(A) Four-tailed bandage. (B) Four-tailed bandage applied to chin. (C) Four-tailed bandage applied to nose.

136.17

Figure 4-24.—Four-tailed bandages.

with wounds that are likely to stick to the wound, leave lint, or be difficult to remove.

Bandages are strips or rolls of gauze or other materials that are used for wrapping or binding any part of the body and to hold compresses in place. The types of bandages that are most commonly used are the roller bandage and the triangular bandage that can be used to make the Barton bandage and the cravat bandage.

### Roller Bandage

The roller bandage, shown in figure 4-23, consists of a long strip of material (usually gauze, muslin, or elastic) that is wound into a cylindrical shape. Roller bandages come in various widths and lengths. Most of the roller bandages in the first aid kits have been sterilized, so pieces may

be cut off and used as compresses in direct contact with wounds. If you use a piece of roller bandage in this manner, you must be careful not to touch it with your hands or with any other unsterile object.

A piece of roller bandage maybe used to make a four-tailed bandage. This is done by splitting the cloth from each end, leaving as large a center area as necessary. Figure 4-24A shows a bandage of this kind. The four-tailed bandage is often used to hold a compress on the chin, as shown in figure 4-24B, or on the nose, as shown in figure 4-24C. It is good for bandaging any protruding part of the body, because the center portion of the bandage forms a smoothly fitting pocket when the tails are crossed over.

In applying a roller bandage, hold the roll in the right hand so that the loose end is on the bottom; the outside surface of the loose or initial end is next applied to and held on the body part by the left hand. The roll is then passed around the body part by the right hand, which controls the tension and application of the bandage. Two or three of the initial turns of a roller bandage should overlie each other to secure the bandage and to keep it in place (see figure 4-25).

In applying the turns of the bandage, it is often necessary to transfer the roll from one hand to the other. Bandages should be applied evenly, firmly, but not too tightly. Excessive pressure may cause interference with the circulation and may lead to disastrous consequences. In bandaging an extremity, it is advisable to leave the fingers or toes exposed so the circulation of these parts may be readily observed. It is likewise safer to apply a large number of turns of a bandage, rather than to depend upon a few turns applied too firmly to secure a compress.

In applying a wet bandage, or one that may become wet, you must allow for shrinkage. The turns of a bandage should completely cover the skin, as any uncovered areas of skin may become

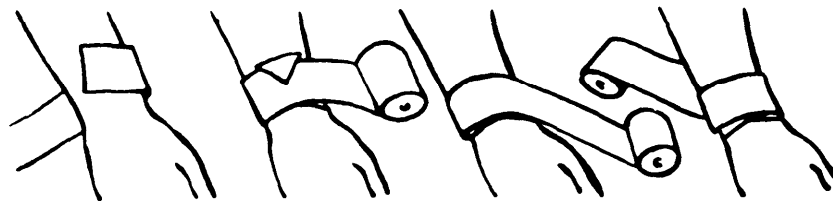


Figure 4-25.—Applying a roller bandage.

154.138

pinched between the turns, with resulting discomfort.

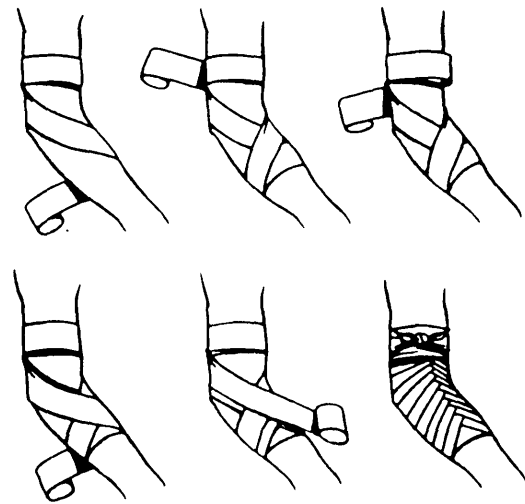
In bandaging any extremity, it is advisable to include the whole member (arm or leg, excepting the fingers or toes) so that uniform pressure may be maintained throughout. It is also desirable in bandaging a limb that the part is placed in the position it will occupy when the dressing is finally completed, as variations in the flexion and extension of the part will cause changes in the pressure of certain parts of the bandage.

The initial turns of a bandage on an extremity (including spica bandages of the hip and shoulder) should be applied securely, and when possible, around the part of the limb that has the smallest circumference. Thus, in bandaging the arm or hand, the initial turns usually are applied around the wrist, and in bandaging the leg or foot, the initial turns are applied immediately above the ankle.

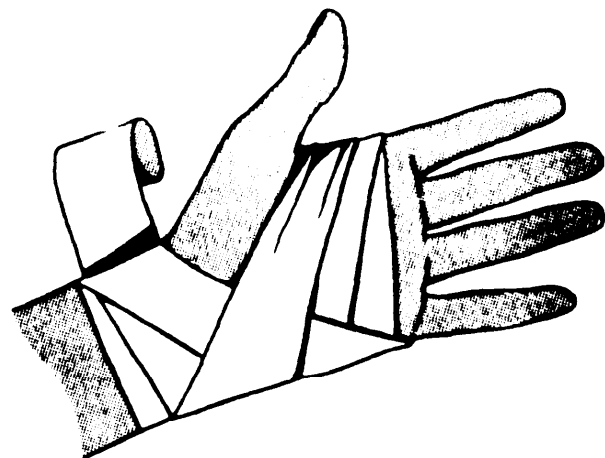
The final turns of a completed bandage usually are secured in the same manner as the initial turns, by employing two or more overlying circular turns. As both edges of the final circular turns are exposed, they should be folded under to present a neat, cufflike appearance. The terminal end of the completed bandage is turned under and secured to the final turns by either a safety pin or adhesive tape. When these are not available, the end of the bandage may be split lengthwise for several inches, and the two resulting tails may be secured around the part by tying.

**ROLLER BANDAGE FOR ELBOW.**— A spica or figure-of-eight type of bandage is used around the elbow joint to retain a compress in the elbow region and to allow a certain amount of movement. Flex the elbow slightly, if you can do so without causing further pain or injury, or anchor a 2- or 3-inch bandage above the elbow and encircle the forearm below the elbow with a circular turn. Continue the bandage upward across the hollow of the elbow to the starting point. Make another circular turn around the upper arm, carry it downward, repeating the figure-of-eight procedure, and gradually ascend the arm. Overlap each previous turn about two-thirds of the width of the bandage. Secure the bandage with two circular turns above the elbow and tie. To secure a dressing on the tip of the elbow, reverse the procedure and cross the bandage in the back (fig. 4-26).

**ROLLER BANDAGE FOR HAND AND WRIST.**— For the hand and wrist, a figure-of-eight bandage is ideal. Anchor the dressing,



154.139  
Figure 4-26.—Roller bandage for the elbow.



154.140  
Figure 4-27.—Roller bandage for the hand and wrist.

whether it is on the hand or wrist, with several turns of a 2- or 3-inch bandage. If on the hand, anchor the dressing with several turns and continue the bandage diagonally upward and around the wrist and back over the palm. Make as many turns as necessary to secure the compress properly (fig. 4-27).

**ROLLER BANDAGE FOR ANKLE AND FOOT.**— The figure-of-eight bandage is also used for dressings of the ankle, as well as for supporting a sprain. While keeping the foot at a right

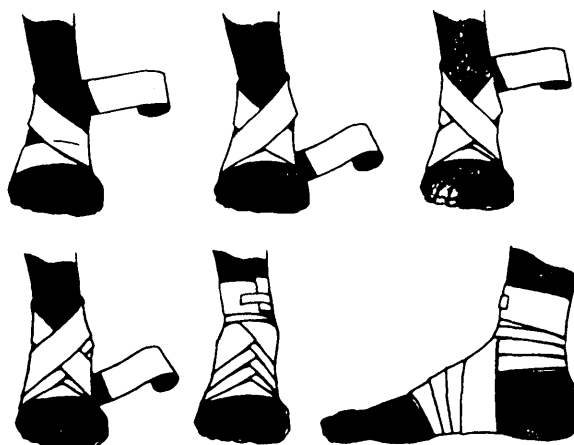
angle, start a 3-inch bandage around the instep for several turns to anchor it. Carry the bandage upward over the instep and around behind the ankle, forward and again across the instep and down under the arch, thus completing one figure-of-eight. Continue the figure-of-eight turns, overlapping one-third to one-half its width, with an occasional turn around the ankle, until the compress is secured or until adequate support is obtained (fig. 4-28).

**ROLLER BANDAGE FOR HEEL.**— The heel is one of the most difficult parts of the body to bandage. Place the free end of the bandage on the outer part of the ankle and bring the bandage under the foot and up. Then carry the bandage over the instep, around the heel, and back over the instep to the starting point. Overlap the lower border of the first loop around the heel and repeat the turn, overlapping the upper border of the loop around the heel. Continue this procedure until the desired number of turns is obtained, and secure with several turns around the lower leg (fig. 4-29).

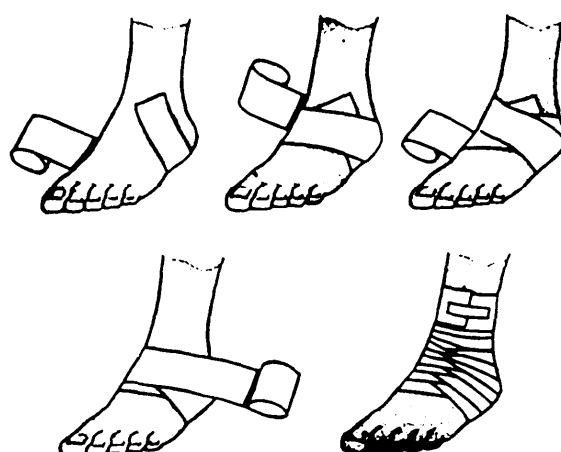
**ROLLER BANDAGE FOR ARM AND LEG.**— The spiral reverse bandage must be used to cover wounds of the forearms and lower extremities; only such bandages can keep the dressing flat and even. Make two or three circular turns around the lower and smaller part of the limb to anchor the bandage and start upward, going around making the reverse laps on each turning, overlapping about one-third to one-half the width of the previous turn. Continue as long as each turn lies flat. Continue the spiral and secure the end when completed (fig. 4-30).

#### Barton Bandage

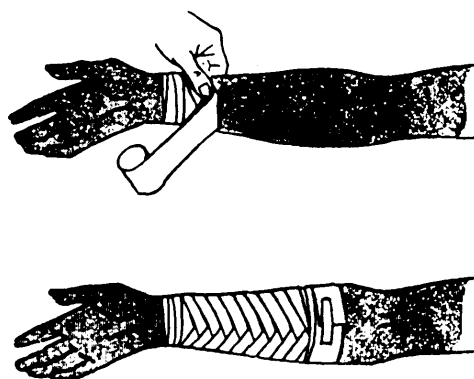
With the initial end of the roller bandage applied to the head, just behind the right mastoid process, the bandage is carried under the bony prominence at the back of the head, upward and forward back of the left ear, obliquely across the top of the head, and downward in front of the right ear. It is then carried under the chin, upward in front of the left ear, obliquely across the top of the head, crossing the first turn in the midline of the head, and then backward and downward to the point of origin behind the right mastoid. Now it is carried around the back of the head under the left ear, around the front of the chin, and under the right ear to the point of origin. This procedure is repeated several times, each turn exactly overlying the preceding turn. The bandage



154.141  
Figure 4-28.—Roller bandage for the ankle and foot.



154.140A  
Figure 4-29.—Roller bandage for the heel.



154.142  
Figure 4-30.—Roller bandage for the arm or leg.

is secured with a pin or strip of adhesive tape at the crossing on top of the head. It may be used for fractures of the lower jaw and to retain compresses to the chin (fig. 4-31).

### Triangular Bandage

Triangular bandages are usually made of muslin. They are made by cutting a 36" to 40" square of a piece of cloth and then cutting the square diagonally, thus making two triangular bandages (in sterile packs on the Navy's medical stock list). A smaller bandage may be made by folding a large handkerchief diagonally. The longest side of the triangular bandage is called the base; the corner directly opposite the middle of the base is called the point; and the other two corners are called ends (fig. 4-32).

The triangular bandage is useful because it can be folded in a variety of ways to fit almost any part of the body. Padding may be added to areas that may become uncomfortable.

#### TRIANGULAR BANDAGE FOR HEAD.—

This bandage is used to retain compresses on the forehead or scalp. Fold back the base about 2 inches to make a hem. Place the middle of the base on the forehead, just above the eyebrows, with the hem on the outside. Let the point fall over the head and down over the occiput (back of the head). Bring the ends of the triangle around the back of the head above the ears, cross them over the point, carry them around the forehead and tie in a **SQUARE KNOT**. Hold the compress firmly with one hand and, with the other, gently pull down the point until the compress is snug; then bring the point up and tuck it over and in the bandage where it crosses the back part of the head (fig. 4-33).

#### TRIANGULAR BANDAGE FOR SHOULDER.—

Cut or tear the point, perpendicular to the base, about 10 inches. Tie the two points loosely around the patient's neck, allowing the base to drape down over the compress on the injured side. Fold the base to the desired width, grasp the ends, and fold or roll the sides toward the shoulder to store the excess bandage. Wrap the ends snugly around the upper arm, and tie on the outside surface of the arm (fig. 4-34).

#### TRIANGULAR BANDAGE FOR CHEST.—

Cut or tear the point, perpendicular to the base about 10 inches. Tie the two points loosely around the patient's neck, allowing the bandage to drape

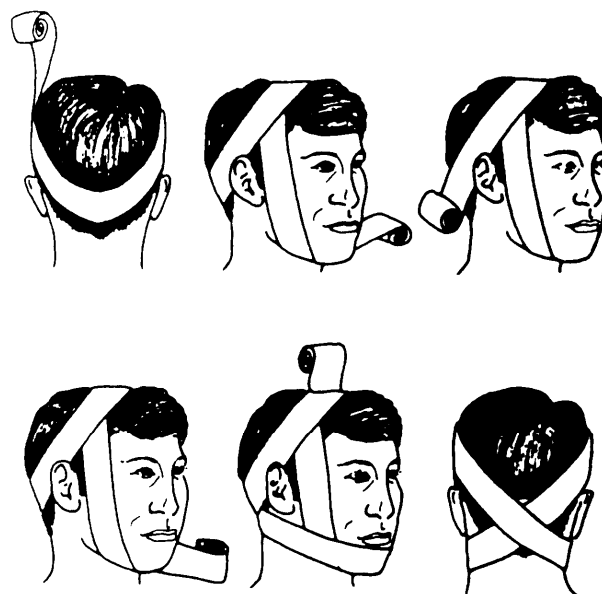


Figure 4-31.—Barton bandage.

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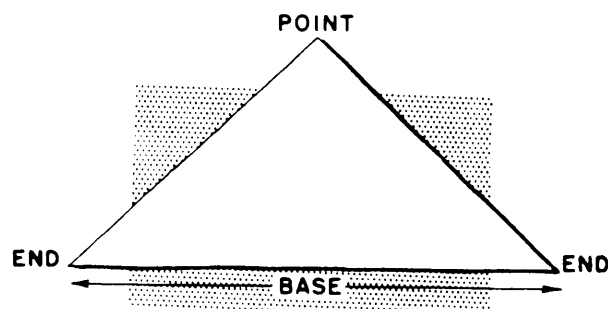


Figure 4-32.—Triangular bandage.

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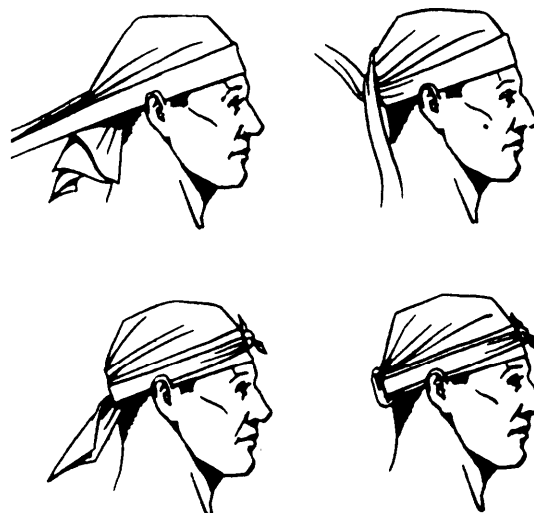


Figure 4-33.—Triangular bandage for the head.

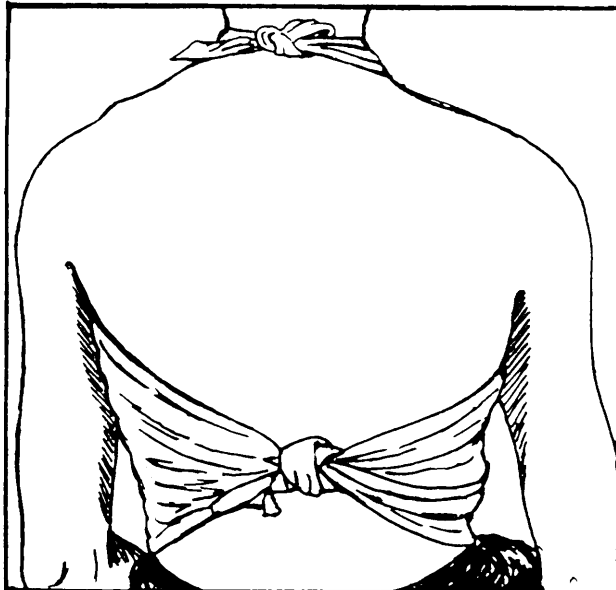
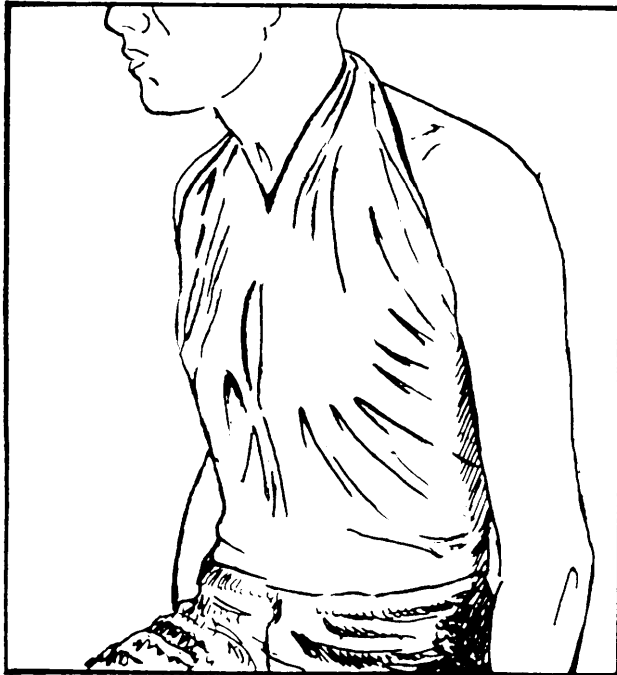
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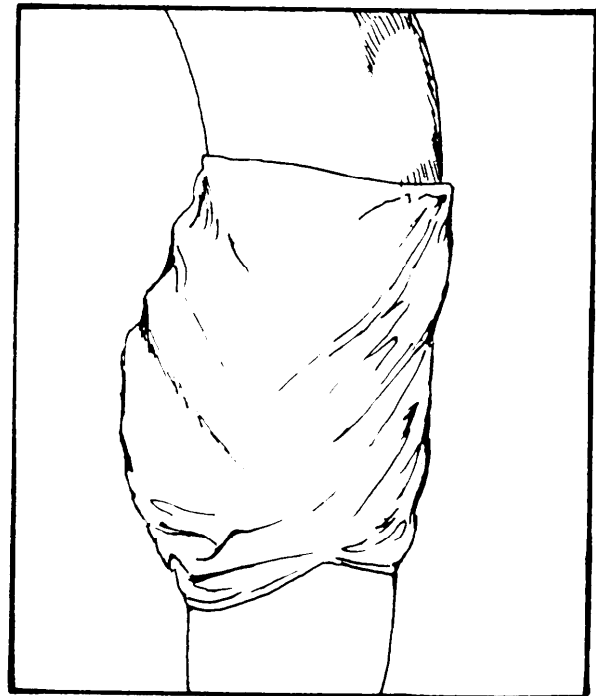
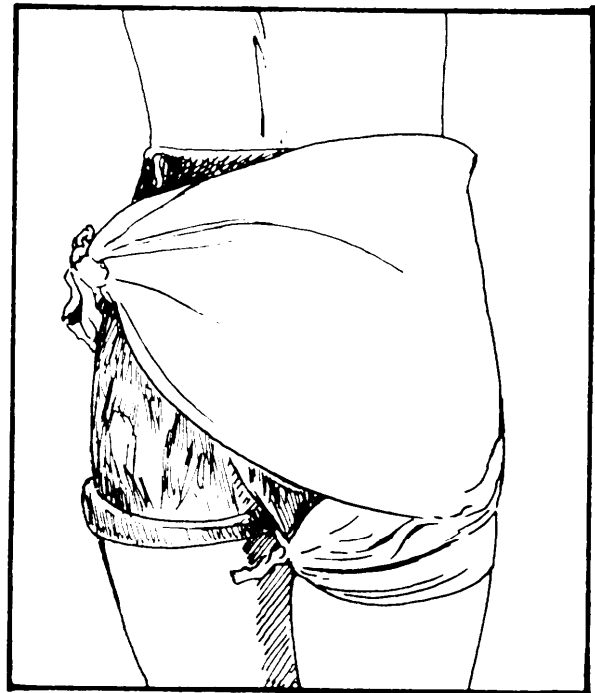
Figure 4-34.—Triangular bandage for the shoulder.

down over the chest. Fold the bandage to the desired width, carry the ends around to the back, and secure by tying (fig. 4-35).

**TRIANGULAR BANDAGE FOR HIP OR BUTTOCK.**— Cut or tear the point, perpendicular to the base, about 10 inches. Tie the two points around the thigh on the injured side. Lift the base up to the waistline, fold to the desired



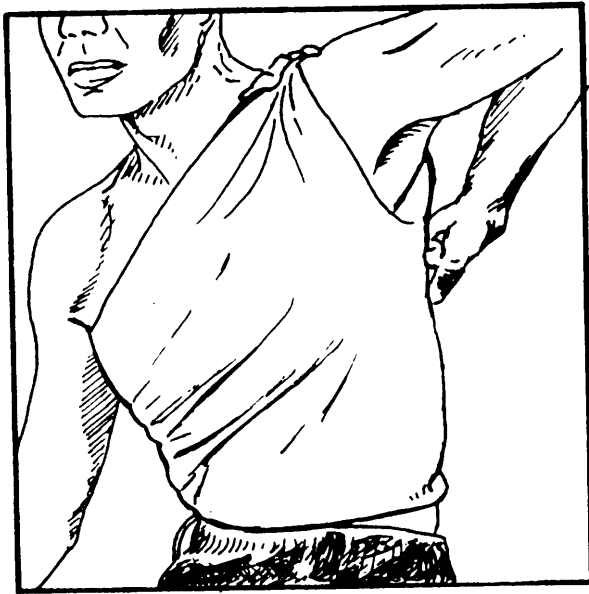
154.166  
Figure 4-35.—Triangular bandage for the chest.



154.167  
Figure 4-36.—Triangular bandage for the hip or buttock.

width, grasp the ends, fold or roll the sides to store the excess bandage, carry the ends around the waist, and tie on the opposite side of the body (fig. 4-36).

**TRIANGULAR BANDAGE FOR SIDE OF CHEST.**— Cut or tear the point, perpendicular



154.168  
Figure 4-37.-Triangular bandage for the side of the chest.

to the base, about 10 inches. Place the bandage, points up, under the arm on the injured side. Tie the two points on top of the shoulder. Fold the base to the desired width, carry the ends around the chest, and tie on the opposite side (fig. 4-37).

**TRIANGULAR BANDAGE FOR FOOT.-**  
This bandage is used to retain large compresses

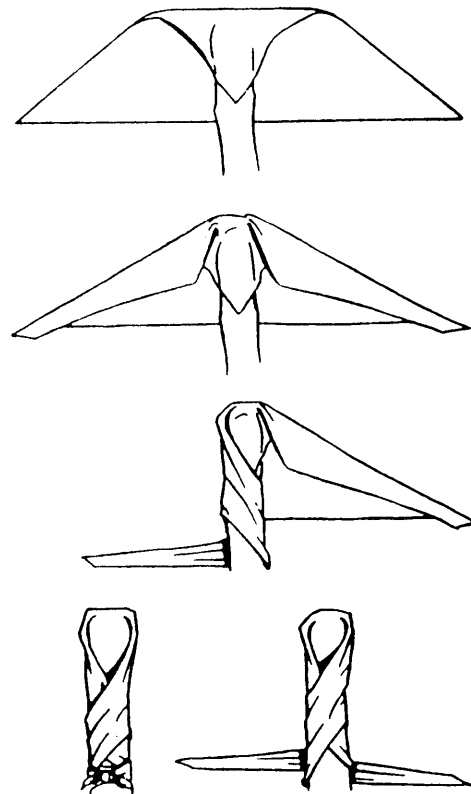
on the foot. After the compresses are applied, place the foot in the center of a triangular bandage and carry the point over the ends of the toes and over the upper side of the foot to the ankle. Fold in excess bandage at the side of the foot, cross the ends, and tie in a square knot in front (fig. 4-38).

#### **TRIANGULAR BANDAGE FOR HAND.-**

This bandage is used to retain large dressings on the hand. After the dressings are applied, place the base of the triangle well up in the palmar surface of the wrist. Carry the point over the ends of the fingers and back of the hand well up on the wrist. Fold the excess bandage at the side of the hand, cross the ends around the wrist, and tie a square knot in front (fig. 4-38).

#### **Cravat Bandage**

To make a cravat bandage, bring the point of the triangular bandage to the middle of the base



154.144  
Figure 4-38.—Triangular bandage for the foot or hand.

and continue to fold until a 2 inch width is obtained (fig. 4-39).

**CRAVAT BANDAGE FOR HEAD.**— This bandage is useful to control bleeding from wounds of the scalp or forehead. After placing a compress over the wound, place the center of the cravat over the compress and carry the ends around to the opposite side; cross them, continue to carry them around to the starting point, and tie in a square knot.

**CRAVAT BANDAGE FOR EYE.**— After applying a compress to the affected eye, place the center of the cravat over the compress and on a slant so that the lower end is inclined downward. Bring the lower end around under the ear on the opposite side. Cross the ends in back of the head, bring them forward, and tie them over the compress (fig. 4-40).

**CRAVAT BANDAGE FOR TEMPLE, CHEEK, OR EAR.**— After a compress is applied to the wound, place the center of the cravat over it and hold one end over the top of the head, carry the other under the jaw and up the opposite side, over the top of the head, and cross them at right angles over the temple on the injured side. Continue one end around over the forehead and the other around the back of the head to meet over

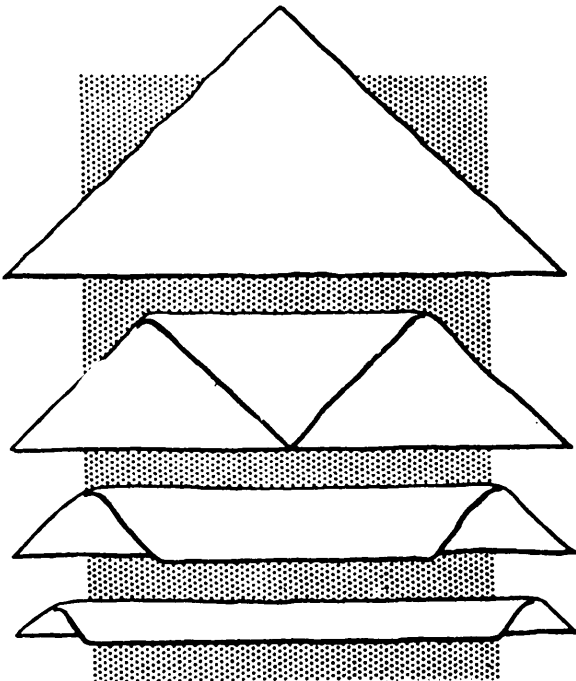


Figure 4-39.—Cravat bandage.

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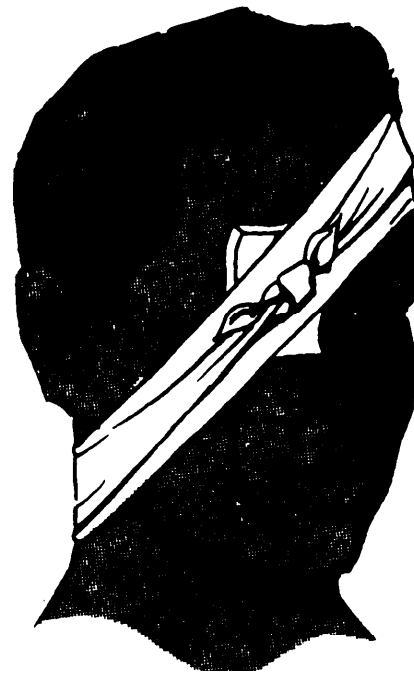


Figure 4-40.—Cravat bandage for the eye.

154.146

the temple on the uninjured side. Tie the ends in a square knot. This bandage is also called a Modified Barton (fig. 4-41).

**CRAVAT BANDAGE FOR ELBOW OR KNEE.**— After applying the compress, and if the injury or pain is not too severe, bend the elbow or knee to a right angle position before applying the bandage. Place the middle of a rather wide cravat over the point of the elbow or knee, and carry the upper end around the upper part of the elbow or knee, bringing it back to the hollow, and the lower end entirely around the lower part, bringing it back to the hollow. See that the bandage is smooth and fits snug; then tie in a square knot outside of the hollow (fig. 4-42).

**CRAVAT BANDAGE FOR ARM OR LEG.**— The width of the cravat you use will depend upon the extent and area of the injury. For a small area, place a compress over the wound and center the cravat bandage over the compress. Bring the ends around in back, cross them, and tie over the compress. For a small extremity it may be necessary to make several turns around to use all the bandage for tying. If the wound covers a larger area, hold one end of the bandage above the compress and wind the other end spirally downward across the compress until it is secure, then upward and around again, and tie a knot where both ends meet (fig. 4-43).

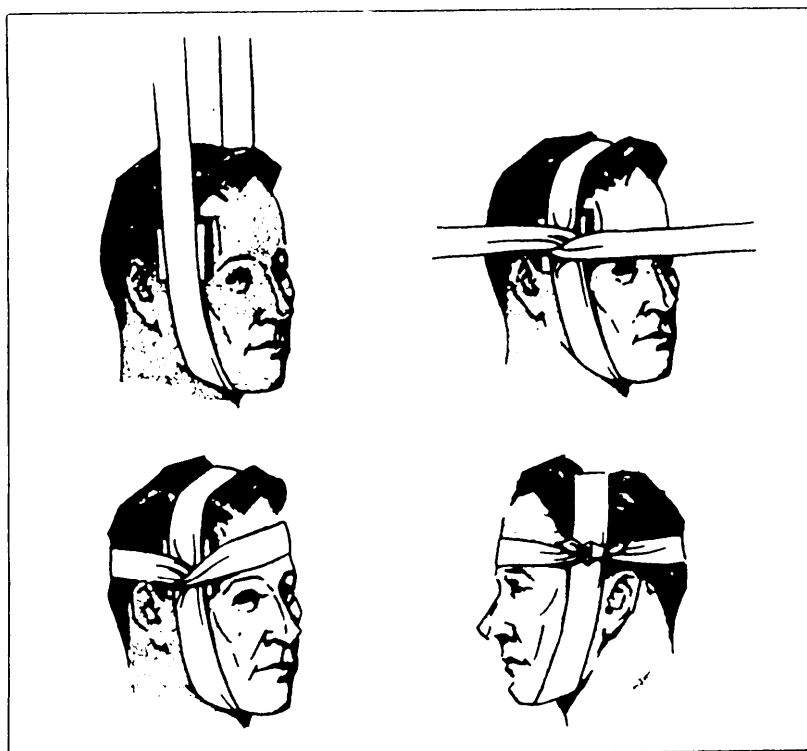


Figure 4-41.—Cravat bandage for the temple, cheek, or ear.

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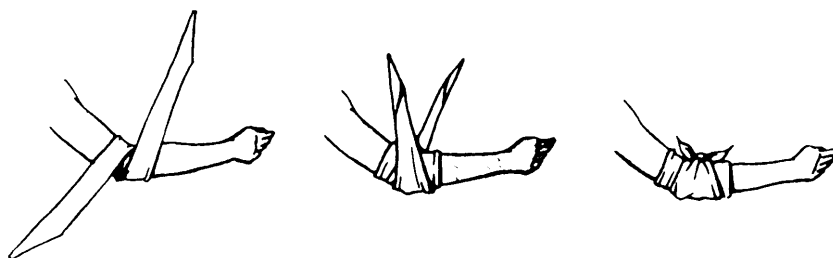


Figure 4-42.—Cravat bandage for the elbow or knee.

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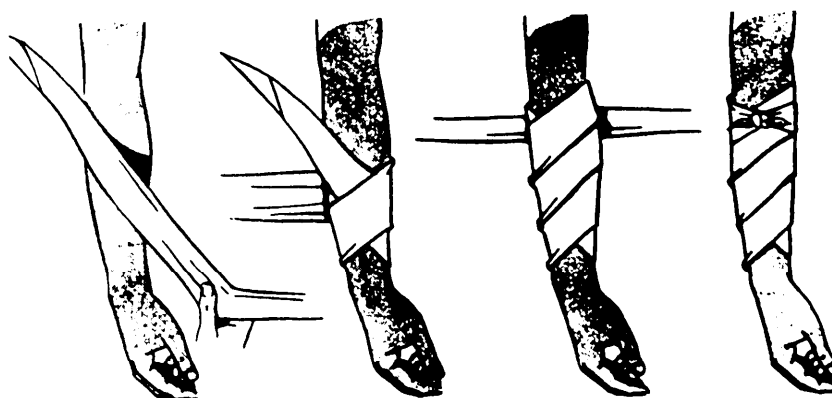
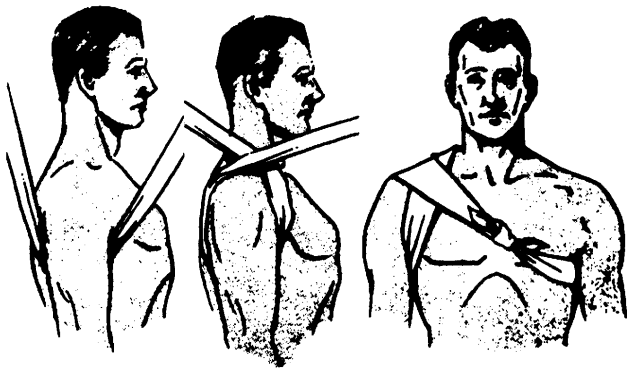


Figure 4-43.—Cravat bandage for the arm, forearm, leg or thigh.

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154.150

**Figure 4-44.—Cravat bandage for the axilla.**

**CRAVAT BANDAGE FOR AXILLA (ARMPIT).—** This cravat is used to hold a compress in the axilla. It is similar to the bandage used to control bleeding from the axilla. Place the center of the bandage in the axilla over the compress and carry the ends up over the top of the shoulder and cross them. Continue across the back and chest, to the opposite axilla and tie them. Do not tie too tightly or the axillary artery

will be compressed, adversely affecting the circulation of the arm (fig. 4-44).

### **Battle Dressings**

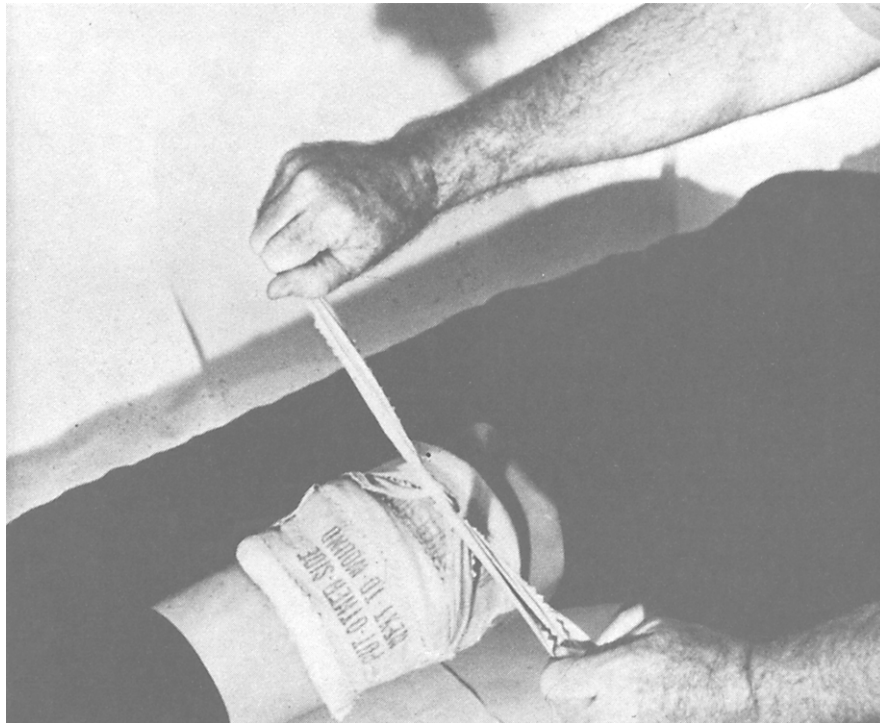
A battle dressing is a combination compress and bandage in which a sterile gauze pad is fastened to a gauze, muslin, or adhesive bandage. Most Navy first aid kits contain both large and small battle dressings of this kind (fig. 4-45).

Any part of a dressing that is to come in direct contact with a wound should be absolutely sterile, i.e., it should be free from microorganisms. The dressings that you will find in first aid kits have been sterilized. However, if you touch them with your fingers, your clothes, or any other unsterile object, they are no longer sterile. If you drag a dressing across the victim's skin or allow it to slip after it is in place, the dressing is no longer sterile.

### **SPECIAL WOUNDS**

#### **Animal Bites**

A special kind of infection that must be guarded against in case of animal bites is rabies



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**Figure 4-45.—Battle dressing.**

(sometimes called “hydrophobia”). This disease is caused by a virus that is present in the saliva of infected animals. The disease occurs most commonly in wild animals, but it has been found in domestic animals and household pets; in fact, it is probable that all mammals are susceptible to it. The virus that causes rabies is ordinarily transmitted by a bite, but it can be transmitted by the saliva of an infected animal coming in contact with a fresh wound or with the thin mucous membrane of the lips or nose. The virus does not penetrate normal unbroken skin. If the skin is broken, **DO NOT** attempt wound closure.

If rabies develops in man, it is usually fatal. A preventive treatment is available that is very effective if it is started shortly after the bite; this treatment is outlined in BUMEDINST 6220.6 series. Since the vaccine can be obtained only at a medical treatment facility or a major ship, any person bitten by an animal **MUST** be transferred quickly to the nearest treatment facility for evaluation, along with a complete report of the circumstances surrounding the incident. Remember, prevention is of utmost importance.

Immediate local treatment of the wound should be given. Wash the wound and the surrounding area carefully, using sterile gauze, soap, and sterile water. Use sterile gauze to dry the wound, and then cover the wound with a sterile dressing. **DO NOT** use any chemical disinfectant. Do not attempt to cauterize the wound in any way.

All of the animal’s saliva must be removed from the victim’s skin to prevent further contamination of the wound. (**CAUTION: DO NOT** allow the animal’s saliva to come in contact with open sores or cuts on your hands.)

When a person has been bitten by an animal, every effort must be made to catch the animal to keep it confined for a minimum of 8 to 10 days. **DO NOT** kill it if there is any possible chance of catching it alive. The symptoms of rabies are not always present in the animal at the time the bite occurs, but the saliva may nevertheless contain the rabies virus. It is essential, therefore, that the animal is kept under observation until a diagnosis can be made. The rabies treatment is given if the animal develops any definite symptoms, if it dies during the observation period, or if for any reason the animal cannot be kept under observation.

Remember that any animal bite is dangerous and **MUST** be evaluated at a treatment facility.

## **SPECIAL CONSIDERATIONS IN WOUND TREATMENT**

### **Shock**

Shock is likely to be severe in a person who has lost a large amount of blood or suffered any serious wound. The causes and treatment of shock are explained elsewhere in this chapter.

### **Infection**

Although infection may occur in any wound, it is a particular danger in wounds that do not bleed freely; in wounds in which torn tissue or skin falls back into place and prevents the entrance of air; and in wounds that involve the crushing of tissues. Incisions, in which there is a free flow of blood and relatively little crushing of tissues, are the least likely to become infected.

Battle wounds are especially likely to become infected. They present the problem of devitalized tissue, extravasated blood, foreign bodies such as missile fragments, bits of cloth, dirt, dust, and a variety of bacteria. The devitalized tissue proteins and extravasated blood provide a nutritional medium for the support of bacterial growth and thus are conducive to the development of serious wound infection. Puncture wounds are also likely to become infected by the germs causing tetanus.

There are two types of bacteria commonly causing infection in wounds—aerobic and anaerobic. The former bacterial live and multiply in the presence of air or free oxygen, while the latter are bacterial that live and multiply only in the absence of air.

The principal aerobic bacteria that cause infection, inflammation, and septicemia (blood poisoning) are streptococci and staphylococci, some varieties of which are hemolytic (destroy red blood cells). The staphylococci and streptococci may be introduced at the time of infliction, or they may be introduced to the wound later, at the time of first aid treatment or in the hospital if nonsterile instruments or dressings are employed.

Wash minor wounds immediately with soap and clean water; then dry and paint them with a mild, nonirritating antiseptic. Apply a dressing if necessary. In the first aid environment, do not attempt to wash or clean a large wound, and do not apply an antiseptic to it since it must be cleaned thoroughly at a medical treatment facility. Simply protect it with a large compress or dressing and transport the victim to a medical treatment facility. After an initial soap and water

cleanup, puncture wounds must also be directed to a medical treatment facility for evaluation.

## Inflammation

Inflammation is a local reaction to irritation. It occurs in tissues that are injured, but not destroyed. Symptoms include redness, pain, heat, swelling, and sometimes loss of motion.

The body's physiologic response to the irritation is to dilate local blood vessels, which increases the blood supply to the area, which in turn causes the skin to appear red and warmer. As the blood vessels dilate, their injured walls leak blood serum into surrounding tissues, causing edema and pain from increased pressure on nerve endings. In addition, white blood cells increase in the area and act as scavengers (phagocytes) in destroying bacteria and ingesting small particles of dead tissue and foreign matter.

Inflammation may be caused by trauma or mechanical irritation; chemical reaction to venom, poison ivy, acids, or alkalies; heat or cold injuries; microorganism penetration; or other agents such as electricity or solar radiation.

Inflammation should be treated by the following methods:

1. Remove the irritating cause.
2. Keep the inflamed area at rest and elevated.
3. Apply cold for 24 to 48 hours to reduce swelling. Once swelling is reduced, apply heat to soft tissues, which hastens the removal of products of inflammation.
4. Apply wet dressings and ointments to soften tissues and to rid the area of the specific causal bacteria.

## Abscesses

An abscess is a localized collection of pus that forms in cavities created by the disintegration of tissue. Abscesses may follow injury, illness, or irritation. Most are caused by staphylococcal infections and may occur in any area of the body, but are usually on the skin surface.

A **FURUNCLE** (boil) is an abscess in the true skin caused by the entry of microorganisms through a hair follicle or sweat gland. A **CARBUNCLE** is a group of furuncular abscesses having multiple sloughs, often interconnected under the true skin. When localized, there are several "heads." Symptoms begin with localized itching and inflammation, followed by swelling, fever, and pain. Redness and swelling localize, and the

furuncle or carbuncle becomes hard and painful. Pus forms into a cavity, causing the skin to become taut and discolored.

Treatment for furuncles and carbuncles includes the following:

1. **DO NOT** squeeze; this may damage surrounding healthy tissue and spread the infection.
2. Use aseptic techniques when handling.
3. Relieve pain with aspirin.
4. Apply moist hot soaks/dressings (110°F) for 40 minutes, three to four times per day.
5. Rest and elevate the infected body part.
6. Antibiotic therapy may be ordered by a physician.
7. Abscesses should be incised after they have localized (except on the face) to establish drainage. Abscesses in the facial triangle (nose and upper lip) should be seen by a physician.

## EYE WOUNDS

Many eye wounds contain foreign objects. Dirt, coal, cinders, eyelashes, bits of metal, and a variety of other objects may become lodged in the eye. Since even a small piece of dirt is intensely irritating to the eye, the removal of such objects is important. However, the eye is easily damaged. Impairment of vision (or even total loss of vision) can result from fumbling, inexperienced attempts to remove foreign objects from the eye. The following precautions **MUST** be observed:

1. **DO NOT** allow the victim to rub the eye.
2. **DO NOT** press against the eye or manipulate it in any way that might cause the object to become embedded in the tissues of the eye. Be very gentle; roughness is almost sure to cause injury to the eye.
3. **DO NOT** use such things as knives, toothpicks, matchsticks, or wires to remove the object.
4. **DO NOT UNDER ANY CIRCUMSTANCES ATTEMPT TO REMOVE AN OBJECT THAT IS EMBEDDED IN THE EYEBALL OR THAT HAS PENETRATED THE EYE!** If you see a splinter or other object sticking out from the eyeball, leave it alone! Only specially trained medical personnel can hope to save the victim's sight if an object has actually penetrated the eyeball.

Small objects that are lodged on the surface of the eye or on the membrane lining the eyelids can usually be removed by the following procedures:

1. Try to wash the eye gently with lukewarm, sterile water. A sterile medicine dropper or a sterile syringe can be used for this purpose. Have the victim lie down, with the head turned slightly to one side as shown in figure 4-46. Hold the eyelids apart. Direct the flow of water to the **INSIDE** corner of the eye, and let it run down to the **OUTSIDE** corner. Do not let the water fall directly onto the eyeball.
2. Gently pull the lower lid down, and instruct the victim to look up. If you can see the object, try to remove it with the corner of a clean handkerchief or with a small moist cotton swab. You can make the swab by twisting cotton around a wooden applicator, not too tightly, and moistening it with sterile water. **CAUTION:** Never use **DRY** cotton anywhere near the eye. It will stick to the eyeball or to the inside of the lids, and you will have the problem of removing it, as well as the original object.
3. If you cannot see the object when the lower lid is pulled down, turn the upper lid back over a smooth wooden applicator. Tell the

victim to look down. Place the applicator lengthwise across the center of the upper lid. Grasp the lashes of the upper lid gently but firmly. Press gently with the applicator. Pull up on the eyelashes, turning the lid back over the applicator. If you can see the object, try to remove it with a moist cotton swab or with the corner of a clean handkerchief.

4. If the foreign object cannot be removed by any of the above methods, **YOU MUST NOT MAKE ANY FURTHER ATTEMPTS TO REMOVE IT.** Instead, place a small, thick gauze dressing over both eyes and hold it in place with a **LOOSE** bandage. This limits movement of the injured eye.
5. Get medical help for the victim at the earliest opportunity.

## HEAD WOUNDS

Head wounds must be treated with particular care, since there is always the possibility of brain damage. The general treatment for head wounds is the same as that for other fresh wounds. However, certain special precautions must be observed if you are giving first aid to a person who has suffered a head wound.

1. **NEVER GIVE ANY MEDICINE.**
2. Keep the victim lying flat, with the head at the level of the body. Do not raise the feet if the face is flushed. If the victim is having trouble breathing, you may raise the head slightly.
3. If the wound is at the back of the head, turn the victim on his or her side.
4. Watch closely for vomiting and position the head to avoid aspiration of vomitus or saliva into the lungs.
5. Do not use direct pressure to control hemorrhage if the skull is depressed or obviously fractured.

## FACIAL WOUNDS

Wounds of the face are treated, in general, like other fresh wounds. However, in all facial injuries make sure the tongue or injured soft tissue does not block the airway, causing a breathing obstruction. Keep the nose and throat clear of any obstructing materials and position the victim so that blood will drain out of the mouth and nose.

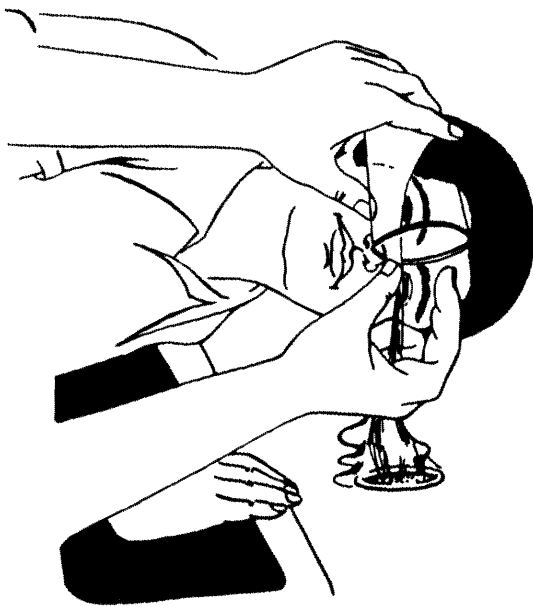


Figure 4-46-Irrigating the eye.

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Facial wounds that involve the eyelids or the soft tissue around the eye must be handled carefully to avoid further damage. If the injury does not involve the eyeball, apply a sterile compress and hold it in place with a FIRM bandage. If the eyeball appears to be injured, use a LOOSE bandage. (Remember that you must NEVER attempt to remove any object that is embedded in the eyeball or that has penetrated it; just apply a dry, sterile compress to cover both eyes and hold it in place with a LOOSE BANDAGE).

Any person who has suffered a facial wound that involves the eye, the eyelids, or the tissues around the eye must receive medical attention as soon as possible. Be sure to keep the victim lying down; you must use a stretcher for transport.

## CHEST WOUNDS

All chest injuries must be considered as serious conditions, for chest injuries may cause severe breathing and bleeding problems. Any victim showing signs of difficulty in breathing without signs of airway obstruction must be inspected for chest injuries. The most serious chest injury that requires immediate first aid treatment is the SUCKING CHEST WOUND. This is a penetrating injury to the chest that produces a hole in the chest cavity, causing the lung to collapse, which prevents normal breathing functions. This is an extremely serious condition that will result in death if not treated quickly.

Victims with open chest wounds gasp for breath, have difficulty breathing out, and may have a bluish skin color to their face. A frothy looking blood may bubble from the wound during breathing.

The proper treatment for a sucking chest wound is as follows:

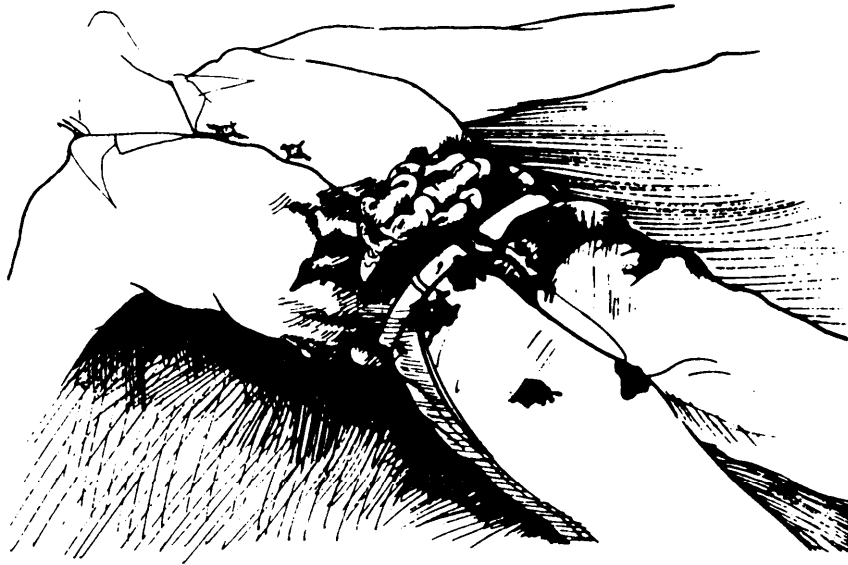
1. Immediately seal the wound with a hand or any airtight material available (e.g., ID card). The material must be large enough so that it cannot be sucked into the wound when the victim breathes in.
2. Firmly tape the material in place with strips of adhesive tape and secure it with a pressure dressing. It is important that the dressing is airtight, otherwise, it will not relieve the victim's breathing problems. The object of the dressing is to keep air from going in through the wound. NOTE: If the victim's condition suddenly deteriorates when you apply the seal, IMMEDIATELY remove it.

3. Give the victim oxygen if it is available and you know how to use it.
4. Place the victim in a Fowler's or semi-Fowler's position. This makes breathing a little easier. During combat lay the victim on a stretcher on the affected side.
5. Watch the victim closely for signs of shock and treat accordingly.
6. Do not give victims with chest injuries anything to drink.
7. Transport the victim to a medical treatment facility immediately.

## ABDOMINAL WOUNDS

A deep wound in the abdomen is likely to constitute a major emergency since there are many vital organs in this area. Abdominal wounds usually cause intense pain, nausea and vomiting, spasm of the abdominal muscles, and severe shock. Immediate surgical treatment is almost always required; therefore, the victim must receive medical attention at once, or the chances of survival will be poor. Give only the most essential first aid treatment and concentrate your efforts on getting the victim to a medical treatment facility. The following first aid procedures may be of help to a person suffering from an abdominal wound:

1. Keep the victim in a supine position. [If the intestine is protruding or exposed, the victim may be more comfortable with the knees drawn up. Place a coat, pillow, or some other bulky cloth material under the knees to help maintain this position. **DO NOT ATTEMPT TO PUSH THE INTESTINE BACK IN OR TO MANIPULATE IT IN ANY WAY!**
2. If bleeding is severe, try to stop it by applying direct pressure.
3. If the intestine is not exposed, cover the wound with a dry sterile dressing. If the intestine is exposed, apply a sterile compress moistened with sterile water. If no sterile water is available, clean sea water or any water that is fit to drink may be used to moisten the compress. Figure 4-47 shows an abdominal wound with the intestine protruding. Figure 4-48 shows the application of compresses large enough to cover the wound and the surrounding area. The compress should be held in place by a bandage. Fasten the bandage firmly so that the compress will not slip around, but do not



136.14

Figure 4-47.—Protruding abdominal wounds.



136.14A

Figure 4-48.—Applying compresses to a protruding abdominal wound.

apply any more pressure than is necessary to hold the compress in position. Large battle dressings are ideal.

4. Treat for shock, but do not waste any time doing it. The victim must be transported to a hospital at the earliest possible opportunity. However, you can minimize the

severity of shock by making sure that the victim is comfortably warm and kept in the supine position. **DO NOT GIVE ANYTHING TO DRINK.** If the victim is thirsty, moisten the mouth with a small amount of water but do not allow any liquid to be swallowed.

5. Upon the direction of a medical officer, start an intravenous line.

## REMOVING FOREIGN OBJECTS

Many wounds contain foreign objects. Wood or glass splinters, bullets, metal fragments, bits of wire, fishhooks, nails, tacks, cinders, and small particles from grinding wheels are examples of the variety of objects or materials that are sometimes found in wounds. In some cases, first aid treatment for wounds includes the removal of such objects when they are near the surface and exposed. However, first aid treatment does not include the removal of deeply embedded objects, powdered glass, or any widely scattered material of this nature. You should never attempt to remove bullets, but you should try to find out whether the bullet remains in the victim; look for both entrance and exit wounds. The general rule to remember is this: Remove foreign objects from a wound when you can do so easily and without causing further damage; but **NEVER HUNT FOR OR ATTEMPT TO REMOVE DEEPLY BURIED OR WIDELY SCATTERED OBJECTS OR MATERIALS** except in a definitive care environment.

The following procedure may be used to remove a small object from the skin or tissues if the object is near the surface and clearly visible:

1. Cleanse the skin around the object with soap and water and paint with any available skin antiseptic solution.
2. If necessary, pierce the skin with a sharp instrument (a needle, razor, or sharp knife that has been sterilized by passing it through a flame several times).
3. Grasping the object at the end, remove it. Tweezers, small pincers, or forceps maybe used for this purpose. (Whatever instrument you use should first be sterilized by boiling if at all possible.)
4. If the wound is superficial, apply gentle pressure to encourage bleeding.
5. Cover the wound with a dry, sterile dressing.

If the foreign object is under a fingernail or toenail, you may have to cut a V-shaped notch in the nail so that the object can be grasped by the forceps. Do not try to dig the object out from under to nail with a knife or similar instrument.

A curved or barbed object such as a fishhook may present special problems. Figure 4-49 shows

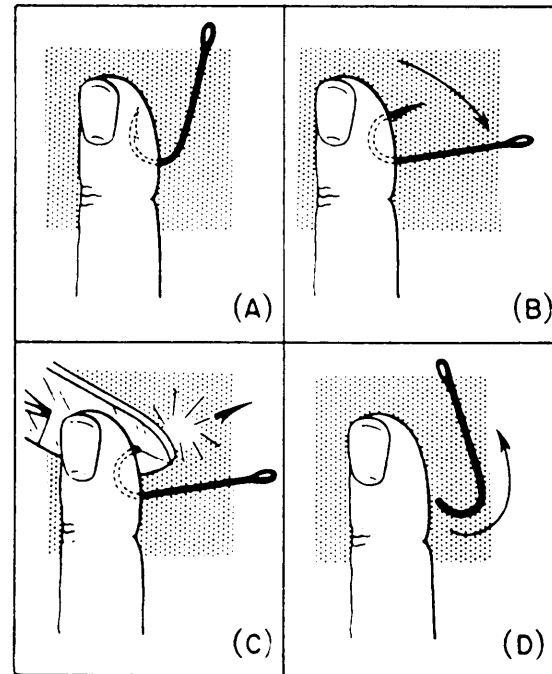


Figure 4-49.—Removing a fishhook.

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one method of removing a fishhook that has become embedded in the flesh. As you can see from figure 4-49A, the barb on the hook prevents its direct removal. However, if you push the hook forward through the skin, as shown in figure 4-49B, you can clip off the barb with a wire cutter or similar tool, as shown in figure 4-49C. The remainder of the fishhook can then be withdrawn in the manner indicated in figure 4-49D.

## WOUND CLOSING

The care of the wound is largely controlled by the tactical situation, facilities available, and the length of time before proper medical care maybe available. Normally, the advice to the corpsman regarding suturing of wounds would be **DO NOT ATTEMPT IT**. However, if days are to elapse before the patient can be seen by a surgeon, the corpsman should know how to use the various suture procedures and materials and how to select the most appropriate of both.

Before discussing the methods of coaptation (bringing together), some of the contraindications to wound closing should be described:

1. If there is reddening and edema of the wound margins, infection manifested by

the discharge of pus, and persistent fever or toxemia, **DO NOT CLOSE THE WOUND**. If these signs are minimal, the wound should be allowed to "clean up." The process may be hastened by warm, moist dressings, and irrigations with sterile saline solutions. These aid in the liquefaction of necrotic wound materials and the removal of thick exudates and dead tissues.

2. If the wound is a puncture wound, a large gaping wound of the soft tissue, or an animal bite, leave it unsutured. Even under the care of a surgeon, it is the rule not to close wounds of this nature until after the fourth day. This is called delayed primary closure and is performed under the indication of a healthy appearance of the wound. Healthy muscle tissue that is viable is evident by its color, consistency, blood supply, and contractibility. Muscle that is dead or dying is comparatively dark and mushy; it does not contract when pinched, nor does it bleed when cut. If this type of tissue is evident, do not close the wound.
3. If the wound is deep, consider the support of the surrounding tissue; if there is not enough support to bring the deep fascia together, do not suture because dead (hollow) spaces will be created. In this generally gaping type of wound, muscles, tendons, and nerves are usually involved. Only a surgeon should attempt to close this type of wound.

To a certain extent, firm pressure dressings and immobilization can obliterate hollow spaces. If tendons and nerves do not seem to be involved, absorbable sutures may be placed in the muscle (great care always being exercised to suture muscle fibers end-to-end and to correctly appose them) and the wound is closed in layers. This is extremely delicate surgery and the corpsman should exercise independent judgment on the advisability of attempting it, and then only if he or she has observed and assisted in numerous surgical operations.

If the wound is small, clean, and free from foreign bodies and signs of infection, steps should be taken to close it. All instruments should be checked, cleaned, and thoroughly sterilized. Use a good light and position the patient on the table so that access to the wound will be unhampered.

The area around the wound should be cleansed and then prepared with an antiseptic. The wound area should be draped, whenever possible, to

maintain a sterile field in which the corpsman works. The corpsman should wear a cap and mask, scrub his or her hands and forearms, and wear sterile gloves.

## Suture Materials

In modern surgery, many kinds of ligature and suture materials are used. All can be grouped into two classes:

1. Nonabsorbable sutures: Those that cannot be absorbed by the body cells and fluids in which they are embedded during the healing process. When used as buried sutures, they become surrounded or encapsulated in fibrous tissue and remain as innocuous foreign bodies. When used as skin sutures, they are removed after the skin has healed. The most commonly used of this type of sutures and facts associated with them are:
  - a. Silk: frequent tissue reaction or "spitting" of suture from the wound.
  - b. Cotton: loses tensile strength with each autoclaving.
  - c. Linen: better than silk or cotton but more expensive and not as readily available.
  - d. Synthetic material: there are many, such as nylon and dermalon. These are excellent, particularly for surface use. They cause very little tissue reaction. Their only problem seems to be the tendency for the knots to come untied, so most surgeons tie 3 to 4 square knots in each suture. Nylon is preferred over silk for face and lip areas because silk too often causes tissue reactions.
  - e. Rust-proof metal: usually stainless steel wire or tantalum. This has the least tissue reaction of all suture material and is by far the strongest. The primary problems are the need for wire cutters, and it is more difficult to use because it kinks.
2. Absorbable sutures: Those that are absorbed or digested by the body cells and tissue fluids in which they are embedded during and after the healing processes. It is this characteristic that enhances their use beneath the skin surfaces and on mucous membranes.

Surgical gut fulfills the requirements for the perfect suture more often than any other material.

- a. Manufacture of catgut: derived from the submucosal connective tissue of the first one-third (about 8 yards) of the small intestine of healthy government inspected sheep. The intestine of the sheep has certain characteristics that make it especially adaptable for surgical use. It is of uniformly fine-grained tissue structure and possesses great tensile strength and elasticity.
- b. Tensile strength of catgut: this suture material is available in sizes of 6-0 to 0 and 1 to 4, with 6-0 being the smallest diameter and 4 being the largest. The tensile strength increases with the diameter of the suture.
- c. Kinds of surgical gut (catgut): this varies from plain catgut, the raw gut that has been gauzed, polished, sterilized, and packaged, to chromic catgut that has undergone various intensities of tanning with one of the salts of chromic acid to delay tissue absorption time. Some examples of these variations and absorption times are as follows:
  - (1) Type A: Plain, 10 days
  - (2) Type B: Mild chromic, 20 days
  - (3) Type C: Medium chromic, 30 days
  - (4) Type D: Extra chromic, 40 days

## Suture Needles

Suture needles may be straight or curved and have either a tapered round point or a cutting edge point. They vary in length, curvature, and diameter for various types of suturing.

1. Sizing: suture needles are sized by diameter and come in many sizes, depending on use.
2. Taper point: these cause small amounts of tissue damage and are most often used in deep tissues.
3. Cutting edge point: this is the preferred needle for suturing the skin because of the toughness of the skin.
4. Atraumatic (atraumatic, wedged): these needles may either have a cutting edge or taper point and have the suture fixed on the end of the needle by the manufacturer to cause the least tissue trauma.

## Preparation of Casualty

1. Examine the casualty carefully to determine what materials are needed to properly close the wound.
  - a. Select and prepare sterile instruments, needles, and suture materials.
  - b. The patient should be securely positioned so that access to the wound and suture tray is optimal. It is usually not necessary to restrain patients for suturing.
  - c. Make sure a good light is available.
2. Aseptic wound preparation is to be strictly observed. Use mask, cap, and gloves. Thorough cleaning and proper draping is essential.
3. Select an anesthetic with care. Consider the patient's tolerance to pain, time of injury, medications the patient is taking or has been given, and the possible distortion of the tissue when the anesthetic is infiltrated.

The most common local anesthetic used is Xylocaine, which comes in various strengths (0.5%, 1%, 2%) and with or without epinephrine. Injectable containing epinephrine are never to be used on the fingers, toes, ears, or nose because of the vasoconstricting effect of the epinephrine. Epinephrine is also contraindicated in patients with hypertension, diabetes, or heart disease. The three methods of administration are topical, local infiltration, and nerve block. Topical anesthetics are generally reserved for ophthalmic or plastic surgery and nerve blocks are generally accomplished by an anesthesiologist or anesthetist for the surgical patient. For a corpsman, topical anesthesia is limited to the instillation of eyedrops for mild corneal abrasions after all foreign bodies have been removed. **DO NOT** attempt to remove embedded foreign bodies. Nerve blocks are limited to digital blocks wherein the nerve trunks that enervate the fingers or toes are anesthetized. The most common method of anesthesia used by a corpsman is the infiltration of the anesthetizing agent around a wound or minor surgical site.

Obtaining a digital block is a fairly simple procedure, but it should not be attempted except under the supervision of a medical officer or after a great deal of practice. The first step is cleansing the injection site with an antiseptic solution. The anesthetizing agent is then infiltrated into the lateral and medial aspects at the base of the digit with a small bore needle (25- or 26-gauge), taking care not to inject into the veins or arteries.

Proper placement of the anesthesia should result in a loss of sensitivity in a few minutes. This is tested by asking the patient if he or she can distinguish a sharp sensation or pain when a sharp object is gently applied to the skin.

Obtaining local anesthesia is similar except you are anesthetizing nerves immediately adjacent to where you will be working and not nerve trunks. There are two generally accepted methods of infiltrating the anesthesia. One is through the skin surrounding the margin of the wound and the other is through the wound into the surrounding tissue. In either case, sufficient quantities must be infiltrated to effect anesthesia approximately 1/2 inch around the wound, taking care not to inject into a vein or artery.

A note of caution: The maximum recommended amount of Xylocaine to be used is 50 cc for a 1 percent solution or the equivalent.

### General Principles of Wound Suturing

Wounds are closed either primarily or secondarily. A primary closure is within a short time of when the wound occurred; a secondary closure is a delayed closure for up to several days. In general, wounds less than 6 hours old can be closed without the danger of infection. Wounds 6 to 14 hours old may be closed if they are not grossly contaminated and are meticulously cleaned. Wounds 14 to 24 hours old should not be closed primarily. When reddening and edema of the wound margins, discharge of pus, persistent fever, or toxemia are present, do not close the wound. Do not close primarily a large, gaping, soft tissue wound. This type of wound is certain to contain large quantities of bacteria. These wounds will require warm wet dressings and irrigations, along with aseptic care for 3 to 7 days to clear up the wound. Then a delayed wound closure may be performed.

1. Debride the wound area and convert circular wounds to elliptical ones before suturing. Circular wounds cannot be closed with satisfactory cosmetic result.
2. Try to convert a jagged laceration to one with smooth edges before suturing it. Make sure that not too much skin is trimmed off that would make the wound difficult to approximate.
3. Use the correct technique for placing sutures. The needle holder is applied at approximately one quarter of the distance from the blunt end of the needle. Suturing

with a curved needle is done toward the person doing the suturing. Insert the needle into the skin at a 90 degree angle and sweep it through an arclike motion, following the general arc of the needle.

4. Carefully avoid bruising the skin edges being sutured. Use Adson forceps and very lightly grasp the skin edges. It is improper to use dressing forceps while suturing. Since there are no teeth on the grasping edges of the dressing forceps, the force required to hold the skin firmly may be enough to cause necrosis.
5. Do not put sutures in too tightly. Gentle approximation of the skin is all that is necessary. Remember that postoperative edema will occur in and about the wound, making sutures tighter. See figure 4-50.
6. If there is a significant chance that the sutured wound may become infected (e.g., bites, delayed closure, grossly contaminated), place a small iodoform or rubber drain in the wound and remove it in 48 hours.
7. When suturing, the best cosmetic effect is obtained by using numerous interrupted simple sutures placed 1/8 inch apart.

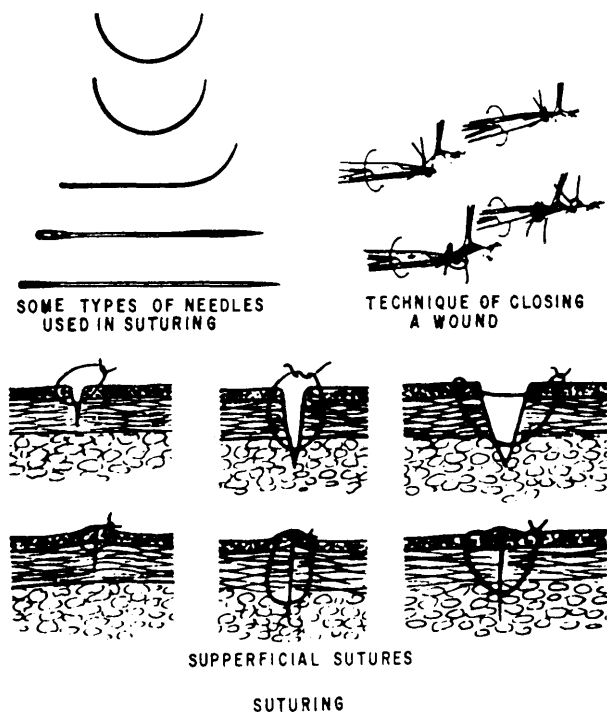


Figure 4-50.—Suturing.

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Where cosmetic result is not a consideration, sutures may be slightly further apart. Generally, the distance of the needle bite from the wound edges should be equal to the distance between sutures.

8. When subcutaneous sutures are needed, it is proper to use 4-0 chromic catgut.
9. When deciding the type of material to use on skin, use the finest diameter that will satisfactorily hold the tissues.
  - a. Children under 3 yrs, face: 6-0
  - b. All other faces 5-0
  - c. Body 4-0
  - d. Feet, elbows, knees #34 or #36 wire or 4-0
  - e. Child's scalp 4-0
  - f. Adult's scalp 3-0
  - g. Lip 6-0 or 5-0
10. When cutting sutures, subcutaneous catgut should have a 1/16 inch tail. Silk skin sutures should be cut as short as is practical for removal on the face and lip. Elsewhere, skin sutures may have longer tails for convenience, but a tail over 1/4 inch is unnecessary and tends to collect exudate.
11. The following general rules can be used in deciding when to remove sutures:
 

Face: As a general rule, 4 or 5 days. Better cosmetic results are obtained by removing every other suture and any suture with redness around it on the third day and the remainder on the fifth day.

Body and scalp: 7 days.

Soles, palms, back or over joints: 10 days unless excess tissue reaction is apparent around the suture, in which case they should come out sooner. Any suture with pus or infection around it should be removed immediately, since its presence will make the infection worse.

When wire is used, it may be left in safely for 10 to 14 days.

## SHOCK

Shock is the collapse of the cardiovascular system, characterized by circulatory deficiency and depression of vital functions. There are several types of shock. Hypovolemic shock is due to diminished blood volume; neurogenic shock results from the loss of vascular control by the nervous system; cardiogenic shock is due to

inadequate functioning of the heart; septic shock develops in the presence of severe infection; and anaphylactic shock is due to an allergic reaction. Multiple types of shock maybe present in varying degrees in the same patient. The most frequently encountered and most important type for the corpsman to understand is hemorrhagic shock, a type of hypovolemic shock.

In shock, the diminished blood volume causes a markedly lessened cardiac output and reduced peripheral circulation. This results in a lowered transport of oxygen to the tissues (hypoxia); decreased perfusion, the circulation of blood within an organ; and a lowered transport of waste products away from the tissue cells. Under these conditions, body cells are able to carry on their normal functions for only a short period of time. Soon they begin to malfunction and then shut down. Certain cells, especially in the heart, brain, liver, and kidneys, are highly susceptible to temporary or permanent damage. Permanent renal shutdown is an ever present danger in shock.

Shock should be expected in all cases of gross hemorrhage, abdominal or chest wounds, crush or blast injuries, extensive large muscle damage, particularly of the extremities, major fractures, traumatic amputations, head injuries, burns involving more than 10 percent of the body surface area, or any other major injury.

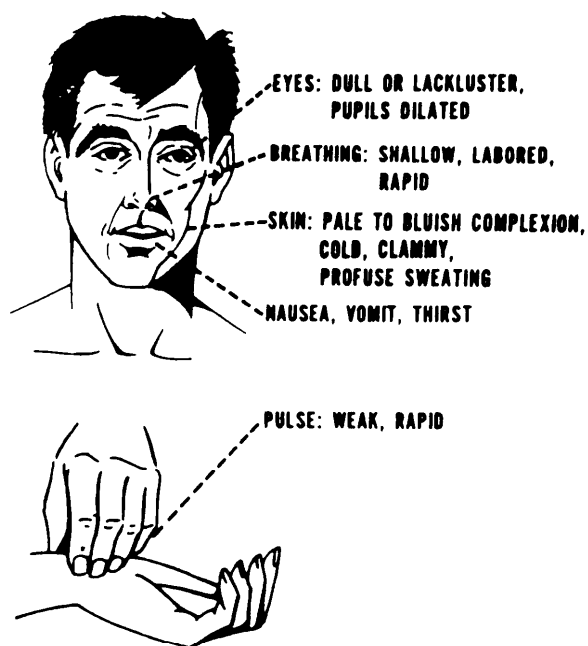


Figure 4-51.—Symptoms of shock.

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**Table 4-4.—Correlation of magnitude of volume deficit and clinical presentation**

Approximate Deficit (ml)	Decrease in Blood Volume %	Degree	Signs
0-500	0-10	None	None
500-1200	10-25	Mild	Slight tachycardia Postural changes in blood pressure Mild peripheral vasoconstriction
1200-1800	25-35	Moderate	Thready pulse 100-120 Systolic blood pressure 90-100 Marked vasoconstriction Diaphoresis Anxiety/restlessness Decreased urine output
1800-2500	35-50	Severe	Thready pulse >120 Systolic blood pressure <60 Increased diaphoresis Obtundation No urine output

The symptoms of shock vary from patient to patient and even during the course of illness in an individual. Evaluation of the whole situation is more important than one particular sign or symptom. Table 4-4 provides a generalized overview of the degrees of shock and their symptoms correlated to the approximate volume deficit.

The essence of shock control and prevention is to recognize the onset of the condition and to start treatment before the symptoms fully develop. The following are general signs and symptoms of the development of shock (see figure 4-51):

1. Restlessness and apprehension are early symptoms, often followed by apathy.
2. Eyes may be glassy, dull and have dilated pupils (these are also the symptoms of morphine use).
3. Breathing may be rapid or labored, often of the gasping "air hunger" type. In the advanced stages of shock, breathing becomes shallow and irregular.
4. The face and skin may be very pale or ashen gray; in the dark complexioned, the mucous membranes may be pale. The lips are often cyanotic.
5. The skin feels cool and is covered with clammy sweat. The coolness is related to a decrease in the peripheral circulation.
6. The pulse tends to become rapid, weak, and thready. If the blood pressure is severely

lowered, the peripheral pulse may be absent. The pulse rate in hemorrhagic shock may reach 140 or higher. An exception is neurogenic shock, where the pulse rate is slowed, often below 60.

7. The blood pressure is usually lowered in moderately severe shock; the systolic pressure drops below 100 while the pulse rises above 100. The body is compensating for circulatory fluid loss by peripheral vasoconstriction. This process tends to maintain the blood pressure at nearly a normal level despite moderately severe loss of circulating blood volume. A point comes, however, when decompensation occurs, and a small additional loss will then produce an alarming and sudden fall in blood pressure.
8. There may be nausea, vomiting, and dryness of the mouth, lips, and tongue.
9. Surface veins may collapse. Veins normally visible at the front of the elbow, forearms, and the back of the hands will be hard to distinguish.
10. There are frequent complaints of thirst. Even the severely wounded may complain of thirst rather than pain.
11. The kidneys may shut down. Urine formation either ceases or becomes greatly diminished if the systolic blood pressure falls below 80 for long periods of time.
12. The person may faint from inadequate venous blood return to the heart. This may be the result of a temporary gravitational pooling of the blood associated with standing up too quickly.

### **Hypovolemic Shock**

This condition is also known as oligemic or hematogenic shock. The essential feature of all forms of hypovolemic shock is loss of fluid from the circulating blood volume, so that adequate circulation cannot be maintained to all parts of the body.

In cases where there is internal or external hemorrhage due to trauma (hemorrhagic shock) there is a loss of whole blood, including red blood cells. The body tends to restore the circulatory volume by supplying fluid from the body tissues. There is a resulting progressive fall in the hematocrit (ratio of red blood cells to plasma) and in the red blood cell count due to hemodilution. However, since hemodilution is not an excessively

rapid process, the hematocrit is a poor indicator of acute blood loss, i.e., less than 24 hours old,

In burn shock, on the other hand, there is a progressively increased hematocrit and red blood cell count due to hemoconcentration from loss of the plasma fraction of the blood into and through the burned area.

A third form of hypovolemic shock occurs in cases of severe diarrhea and vomiting, where body fluids and electrolytes (sodium, potassium, and chloride) are lost. This also contributes to a decrease in circulating blood volume.

### **Neurogenic Shock**

Neurogenic shock, sometimes called vasogenic shock, results from the disruption of autonomic nervous system control over vasoconstriction. Under normal conditions the autonomic nervous system keeps the muscles of the veins and arteries partially contracted. At the onset of most forms of shock, further constriction is signaled. However, the vascular muscles cannot maintain this contraction indefinitely. A number of factors, including increased fluid loss, central nervous system trauma, or emotional shock, can override the autonomic nervous system control. The veins and arteries immediately dilate, drastically expanding the volume of the circulatory system, with a corresponding reduction of blood pressure.

Simple fainting (syncope) is a variation of neurogenic shock. It often is the result of a temporary gravitational pooling of the blood as a person stands up. As the person falls, blood again rushes to the head, and the problem is solved. It may also be induced by fear or horror, which override the autonomic nervous system control.

Other variations of neurogenic shock that are important to the corpsman are shell shock and bomb shock. These are psychological adjustment reactions to extremely stressful wartime experiences and do not relate to the collapse of the cardiovascular system. Symptoms range from intense fear to complete dementia and are manifestations of a loss of nervous control. Care is limited to emotional support and evacuation to the care of a psychiatrist or psychologist.

### **Cardiogenic Shock**

Cardiogenic shock is caused by inadequate functioning of the heart, not by loss of circulating blood volume. If the heart muscle is weakened by disease or damaged by trauma or lack of oxygen, as in cases of pulmonary disease, suffocation, or

myocardial infarction, the heart will no longer be able to maintain adequate circulatory pressure, even though the volume of fluid is unchanged. Shock will develop as the pressure falls. Heart attack is an extreme medical emergency all corpsmen must be ready to handle. It will be discussed in greater detail in the "Common Medical Emergencies" section of this chapter.

### **Septic Shock**

Septic shock usually does not develop for 2 to 5 days after an injury and the corpsman will not often see it in a first aid situation. It may appear during the course of peritonitis caused by penetrating abdominal wounds or perforation of the appendix. It may also result from gross wound contamination, rupture of an ulcer, or as a complication of certain types of pneumonia. Septic shock is the result of vasodilation of small blood vessels in the wound area, or general vasodilation if the infection has entered the bloodstream. In addition to increasing circulatory system volume, the walls of the blood vessels become more permeable, allowing fluids to escape into the tissues. This type of shock carries a poor prognosis and must almost always be treated under the direct supervision of a medical officer.

### **Anaphylactic Shock**

This type of shock occurs when an individual is exposed to a substance to which his or her body is particularly sensitive. In its most severe form, the body goes into an almost instantaneous violent reaction. A burning sensation, itching, and hives spread across the skin. Severe edema effects body parts and the respiratory system. Blood pressure drops alarmingly, and fainting or coma may develop.

The causative agent may be introduced into the body in a number of ways. The injection of medicines, especially penicillin and horse- or egg-cultured serums, is one route. Another is the injection of venoms by stinging insects and animals. The inhalation of dusts, pollens, or other materials to which a person is sensitive is a third route. Finally, a slightly slower but no less severe reaction may develop from the ingestion of certain foods and medications. Specific treatment of venoms and poisons will be discussed in the "Poisons/Drug Abuse" section of this chapter.

## **GENERAL TREATMENT PROCEDURES**

Intravenous fluid administration is the single most important factor in the treatment of any type of shock except cardiogenic shock. The proper use of intravenous equipment and fluids are discussed in the "Patient Care" chapter of the manual. Ringer's lactate is probably the best solution to use, although normal saline is adequate until properly cross-matched whole blood can be administered. The electrolyte solutions replace not only the lost blood volume, but also lost extracellular fluid that has been depleted to bolster the shrunken blood volume. If the shock situation is severe enough to warrant immediate administration of intravenous fluids, or transportation to a medical facility will be delayed and a medical officer is not available in the first aid situation to write an administrative order, be conservative. Start the intravenous fluid and let it run at a slow rate of 50 to 60 drops per minute. If intravenous solutions are unavailable or transportation to a medical treatment facility will be delayed, and there are no contraindications such as gastrointestinal bleeding or unconsciousness, the patient may receive an electrolyte solution by mouth. This may be prepared by adding a teaspoon of salt and half a teaspoon of baking soda to a quart or liter of water. Allow the patient to sip the solution.

### **Pneumatic Counter-Pressure Devices (MAST)**

Commonly known as Medical Anti-Shock Trousers or Military Anti-Shock Trousers, these devices are designed to correct or counteract certain internal bleeding conditions and hypovolemia. The garment does this by developing an encircling pressure up to 120 mm Hg around both lower extremities, the pelvis, and the abdomen. The pressure created:

1. Slows or stops venous and arterial bleeding in areas of the body enclosed by the pressurized garment.
2. Forces available blood from the lower body to the heart, brain, and other vital organs.
3. Prevents pooling of blood in the lower extremities.
4. Stabilizes fractures of the pelvis and lower extremities.

Some indications for use of the pneumatic counter-pressure devices are as follows:

1. Systolic blood pressure less than 80 mm Hg
2. Systolic blood pressure less than 100 mm Hg and the patient exhibits the classic signs of shock
3. Fracture of the pelvis or lower extremities. The only absolute contraindication in their use is pulmonary edema, although conditional contraindications include congestive heart failure, heart attack, stroke, pregnancy, abdominal evisceration, massive bleeding into the thoracic cavity, and penetrating wounds where the object is still impaled in the victim.

Application of the anti-shock garment is a relatively simple procedure but requires some important preliminary steps. When the garment is laid out flat, ensure that there are no wrinkles. If clothing is to remain on the patient, remove all sharp and bulky objects from the patient's pockets. Take vital signs before applying the garment. The garments are inflated only sufficiently to bring the patient's systolic blood pressure to 100 mm Hg and maintain it there. Once the garment is inflated, take vital signs every 5 minutes. The garment is removed only under the direct supervision of a physician. There is no indication for the pre-hospital removal of anti-shock garments.

Other shock treatment procedures to use are as follows:

1. Maintain an open airway. Oxygen may also be administered if proper equipment is available.
2. Control hemorrhage.
3. Check for other injuries that may have been sustained. Remove the victim from the presence of identifiable causative agents.
4. Place the victim in a supine position, with the feet slightly higher than the head (shock position). Certain problems, such as breathing difficulties or head injuries, may require other positioning.
5. Reduce pain by splinting fractures, providing emotional support, and attending to the victim's comfort. Unless contraindicated, aspirin may be dispensed.
6. Conserve body heat.
7. Avoid rough handling and transport the victim to a medical treatment facility.

8. If transportation to a definitive care facility will be lengthy or delayed, seek the radio or phone advice of a medical officer on whether or not to give fluids by mouth or to start an intravenous line. If this is impossible, use your own judgment. Cardiogenic shock is the only exception to this rule. DO NOT start intravenous fluids since volume is sufficient and only function is impaired.
9. Constantly monitor and record vital signs every 15 minutes so that you are able to keep track of the victim's progress.

## **PAIN RELIEF**

As a corpsman in the field or on board ship in wartime, you may be issued morphine for the control of shock through relief of severe pain. You will be issued this controlled drug under very strict accountability procedures. Possession of this drug is a medical responsibility that must not be taken lightly.

### **Morphine Administration**

Morphine is the most effective of all pain-relieving drugs. It is most commonly available in syrettes or tubex in premeasured doses. Properly administered in selected patients, it will relieve distressing pain and assist in the prevention of shock. The adult dose of morphine is 8 to 16 mg repeated, if necessary, in not less than 4 hours. Morphine has several undesirable effects, however, and these must be thoroughly understood by the corpsman.

1. Morphine is a severe respiratory depressant and therefore must not be given to patients in moderate or severe shock or to patients in respiratory distress.
2. Morphine increases intracranial pressure and may induce vomiting; these effects may be disastrous in head injury cases.
3. Morphine causes constriction of the pupils (pinpoint pupils); this effect prevents the use of the pupillary reactions for diagnosis in head injuries.
4. Morphine is cardiotoxic and a peripheral vasodilator. It may cause profound hypotension in small doses in the patient in shock.
5. Morphine poisoning is an ever-present danger. There is a narrow safety margin between the amounts of morphine that may

be given therapeutically and the amounts that produce death.

6. Morphine causes considerable mental confusion and interferes with the proper exercise of judgment and therefore should not be given to ambulatory patients.
7. Morphine is a dangerously habituating drug. It should not be given trivially and must be rigidly accounted for. Under no circumstances should the corpsman administer morphine except in an emergency.

Morphine administration to patients in shock or with extensive burns should be rigidly controlled. Morphine administration by subcutaneous or intramuscular routes may not be absorbed into the bloodstream because of the reduced peripheral circulation, and pain may persist. When this happens, the uninformed often give additional doses, hoping to bring about relief. Then when resuscitation occurs and the peripheral circulation improves, the stored quantities of morphine are released into the system, and an extremely serious condition (morphine poisoning) ensues. When other pain-relieving drugs are not available, and the patient in shock or with burns is in severe pain, 16 mg of morphine may be given intramuscularly (followed by massage of the injection site), but the temptation to give more must be resisted. Doses should not be repeated more than twice and then at least 4 hours apart, unless otherwise ordered by a medical officer.

If the pain from the wound is agonizingly severe, morphine may be given if examination of the patient reveals no:

1. Head injury.
2. Chest injury, including sucking and non-sucking wounds.
3. Wounds of the throat, nasal passages, oral cavity, or jaws wherein blood might obstruct the airway.
4. Massive hemorrhage.
5. Respiratory impairment, including chemical burns of the respiratory tract. Any casualty having fewer than 16 respirations per minute should not be given morphine.
6. Evidence of severe or deepening shock.
7. Loss of consciousness.

Overdose is an ever-present danger. For this reason, every casualty who has received morphine should be plainly identified. Write the letter "M" and the hour of injection on the patient's

forehead, e.g., M0830. A skin pencil, colored antiseptic, or ink maybe used for this purpose. The empty morphine syrette or tubex should be attached to the shirt collar or other conspicuous area of the clothing by a safety pin or other means to alert others that the drug has been administered.

## **INJURIES TO BONES, JOINTS, AND MUSCLES**

Many kinds of accidents cause injuries to bones, joints, or muscles. In giving first aid to an injured person, you must always look for signs of fractures (broken bones), dislocations, sprains, strains, and contusions.

An essential part of the first aid treatment for fractures consists of immobilizing the injured part with splints so that the sharp ends of broken bones will not move around and cause further damage to nerves, blood vessels, or vital organs. Splints are also used to immobilize severely injured joints or muscles and to prevent the enlargement of extensive wounds. You must have a general understanding of the use of splints before going on to learn the detailed first aid treatment for injuries to bones, joints, and muscles.

## **USE OF SPLINTS**

In an emergency, almost any firm object or material will serve as a splint. Thus, umbrellas, canes, rifles, tent pegs, sticks, oars, wire mesh, boards, corrugated cardboard, and folded newspapers can be used as splints. A fractured leg may sometimes be splinted by fastening it securely to the uninjured leg. Whenever available, use manufactured splints such as the pneumatic splints or the traction splints.

Splints, whether manufactured or improvised, must fulfill certain requirements. They should be lightweight, strong, fairly rigid, and long enough to reach past the joints above and below the fracture. They should be wide enough so that the bandages used to hold them in place will not pinch the injured part. Splints must be well padded on the sides touching the body; if they are not properly padded, they will not fit well and will not adequately immobilize the injured part. If you have to improvise the padding for a splint, you may use clothing, bandages, cotton, blankets, or any other soft material. If the victim is wearing heavy clothes, you may be able to apply the splint on the outside, allowing the clothing to serve as at least part of the required padding. Fasten splints in place with bandages, strips of adhesive

tape, clothing, or other suitable materials. If possible, one person should hold the splints in position while another person fastens them.

Although splints should be applied snugly, they should NEVER be tight enough to interfere with the circulation of the blood. When you are applying splints to an arm or a leg, try to leave the fingers or toes exposed. If the tips of the fingers or toes become blue or cold, you will know that the splints or bandages are too tight. You should examine a splinted part approximately every half hour and loosen the fastenings if the circulation appears to be impaired. Remember that any injured part is likely to swell, and splints or bandages that are applied correctly may later become too tight.

## INJURIES TO BONES

A break in a bone is called a FRACTURE. There are two main kinds of fractures. A CLOSED FRACTURE is one in which the injury is entirely internal; the bone is broken but there is no break in the skin. An OPEN FRACTURE is one in which there is an open wound in the tissues and the skin. Sometimes the open wound is made when a sharp end of the broken bone

pushes out through the flesh; sometimes it is made by an object such as a bullet that penetrates from the outside.

Figure 4-52 shows closed (A) and open (B) fractures.

Open fractures are more serious than closed fractures. They usually involve extensive damage to the tissues and are quite likely to become infected. Closed fractures are sometimes turned into open fractures by rough or careless handling of the victim.

It is not always easy to recognize a fracture. All fractures, whether closed or open, are likely to cause severe pain and shock; but the other symptoms may vary considerably. A broken bone sometimes causes the injured part to be deformed or to assume an unnatural position. Pain, discoloration, and swelling may be localized at the fracture site, and there may be a wobbly movement if the bone is broken clear through. It may be difficult or impossible for the victim to move the injured part; if able to move it, there may be a grating sensation (crepitus) as the ends of the broken bone rub against each other. However, if a bone is cracked rather than broken through, the victim may be able to move the injured part without much difficulty. An open fracture is easy to recognize if an end of the broken bone protrudes through the flesh. If the bone does not protrude, however, you might see the external wound but fail to recognize the broken bone.

If you are required to give first aid to a person who has suffered a fracture, you should follow these general rules:

1. If there is any possibility that a fracture has been sustained, treat the injury as a fracture until an x-ray can be made.
2. Get the victim to a definitive care facility at the first possible opportunity. All fractures require medical treatment.
3. Do not move the victim until the injured part has been immobilized by splinting unless the move is necessary to save life or to prevent further injury.
4. Treat for shock.
5. Do not attempt to locate a fracture by grating the ends of the bone together.
6. Do not attempt to set a broken bone, unless a medical officer will not be available for many days.
7. When a long bone in the arm or leg is fractured, the limb should be carefully straightened so that splints can be applied unless it appears that further damage will be

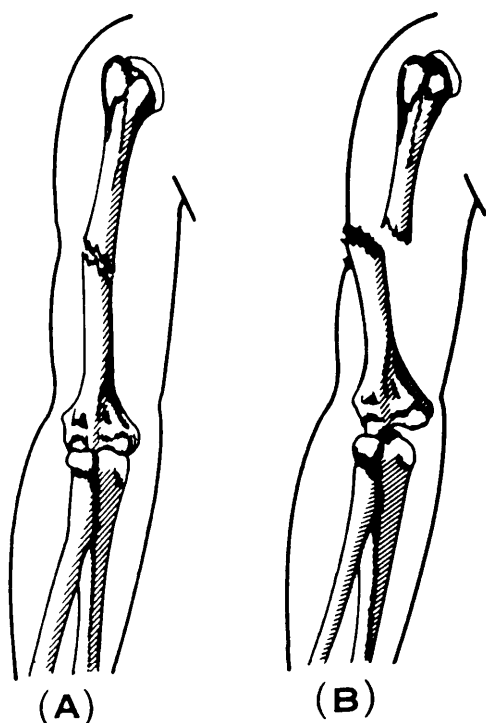


Figure 4-52.—Closed and open fractures.

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caused by such a maneuver. Never attempt to straighten the limb by applying force or traction with an improvised windlass or any other device. Pulling gently with your hands along the long axis of the limb is permissible and may be all that is necessary to get the limb back into position.

8. Apply splints. If the victim is to be transported only a short distance, or if treatment by a medical officer will not be delayed, it is probably best to leave the clothing on and place emergency splinting over it. However, if the victim must be transported for some distance, or if a considerable period of time will elapse before treatment by a medical officer, it may be better to remove enough clothing so that you can apply well padded splints directly to the injured part. If you decide to remove clothing over the injured part, cut the clothing or rip it along the seams. In any case, **BE CAREFUL!** Rough handling of the victim may convert a closed fracture into an open fracture, increase the severity of shock, or cause extensive damage to the blood vessels, nerves, muscles, and other tissues around the broken bone.
9. If the fracture is open, you must take care of the wound before you can deal with the fracture. Bleeding from the wound may be profuse, but most bleeding can be stopped by direct pressure on the wound. Other supplemental methods of hemorrhage control are discussed in the section on wounds of this chapter. Use a tourniquet as a last resort. After you have stopped the bleeding, treat the fracture.

Now that we have seen the general rules for treating fractures, we turn to the symptoms and emergency treatment of specific fracture sites.

### Fracture of the Forearm

There are two long bones in the forearm, the radius and the ulna. When both are broken, the arm usually appears to be deformed. When only one is broken, the other acts as a splint and the arm retains a more or less natural appearance. Any fracture of the forearm is likely to result in pain, tenderness, inability to use the forearm, and a kind of wobbly motion at the point of injury. If the fracture is open, a bone may show through.

If the fracture is open, stop the bleeding and treat the wound. Apply a sterile dressing over the

wound. Carefully straighten the forearm. (Remember that rough handling of a closed fracture may turn it into an open fracture.) Apply a pneumatic splint if available; if not, apply two well-padded splints to the forearm, one on the top and one on the bottom. Be sure that the splints are long enough to extend from the elbow to the wrist. Use bandages to hold the splints in place. Put the forearm across the chest. The palm of the hand should be turned in, with the thumb pointing upward. Support the forearm in this position by means of a wide sling and a cravat bandage, as shown in figure 4-53. The hand should be raised about 4 inches above the level of the elbow. Treat the victim for shock and evacuate as soon as possible.

### Fracture of the Upper Arm

The signs of fracture of the upper arm include pain, tenderness, swelling, and a wobbly motion at the point of fracture. If the fracture is near the elbow, the arm is likely to be straight with no bend at the elbow.



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Figure 4-53.—First aid for a fractured forearm.

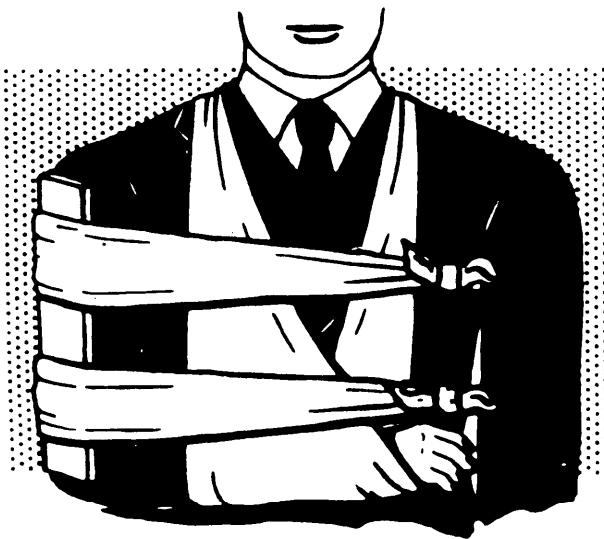
If the fracture is open, stop the bleeding and treat the wound before attempting to treat the fracture. **NOTE THAT TREATMENT OF THE FRACTURE DEPENDS PARTLY UPON THE LOCATION OF THE BREAK.**

If the fracture is in the upper part of the arm near the shoulder, place a pad or folded towel in the armpit, bandage the arm securely to the body, and support the forearm in a narrow sling.

If the fracture is in the middle of the upper arm, you can use one well padded splint on the outside of the arm. The splint should extend from the shoulder to the elbow. Fasten the splinted arm firmly to the body and support the forearm in a narrow sling, as shown in figure 4-54.

Another way of treating a fracture in the middle of the upper arm is to fasten two wide splints or four narrow one about the arm and support the forearm in a narrow sling. If you use a splint between the arm and the body, be very careful that it does not extend too far up into the armpit; a splint in this position can cause a dangerous compression of the blood vessels and nerves and may be extremely painful to the victim.

If the fracture is at or near the elbow, the arm may be either bent or straight. No matter in what position you find the arm, **DO NOT ATTEMPT TO STRAIGHTEN IT OR MOVE IT IN ANY WAY.** Splint the arm as carefully as possible in the position in which you find it. This will prevent further nerve and blood vessel damage. The only exception to this is if there is no pulse distal



136.22  
Figure 4-54.—Splint and sling for a fractured upper arm.

to the fracture, in which case gentle traction is applied and then the arm is splinted. Treat the victim for shock and get him or her under the care of a medical officer as soon as possible.

### Fracture of the Thigh

The femur is the long bone of the upper part of the leg between the kneecap and the pelvis. When the femur is fractured through, any attempt to move the limb results in a spasm of the muscles and causes excruciating pain. The leg has a wobbly motion, and there is complete loss of control below the fracture. The limb usually assumes an unnatural position, with the toes pointing outward. By actual measurement, the fractured leg is shorter than the uninjured one because of contraction of the powerful thigh muscles. Serious damage to blood vessels and nerves often results from a fracture of the femur and shock is likely to be severe.

If the fracture is open, stop the bleeding and treat the wound before attempting to treat the fracture itself. Serious bleeding is a special danger in this type of injury, since the broken bone may tear or cut the large artery in the thigh.

Carefully straighten the leg. Apply two splints, one on the outside of the injured leg and one on the inside. The outside splint should reach from the armpit to the foot. The inside splint should reach from the crotch to the foot. The splints should be fastened in five places: (1) around the ankle; (2) over the knee; (3) just below the hip; (4) around the pelvis; and (5) just below the armpit (fig. 4-55). The legs can then be tied together to support the injured leg as firmly as possible.

It is essential that a fractured thigh be splinted before the victim is moved. Manufactured splints, such as the Hare or the Thomas half-ring traction splints are best, but improvised splints may be used. Figure 4-55 shows how boards may be used as an emergency splint for a fractured thigh. Remember, **DO NOT MOVE THE VICTIM UNTIL THE INJURED LEG HAS BEEN IMMOBILIZED.** Treat the victim for shock, and evacuate at the earliest possible opportunity.

### Fracture of the Lower Leg

When both bones of the lower leg are broken, the usual signs of fracture are likely to be present. When only one bone is broken, the other one acts as a splint and, to some extent, prevents deformity of the leg. However, tenderness, swelling, and pain at the point of fracture are almost always

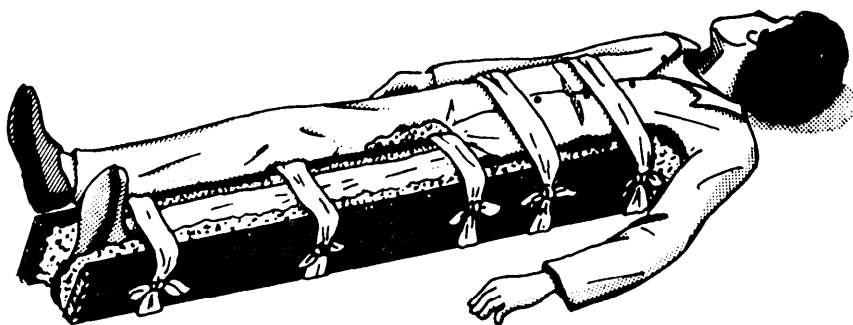


Figure 4-55.—Splint for a fractured femur.

136.24

present. A fracture just above the ankle is often mistaken for a sprain. If both bones of the lower leg are broken, an open fracture is very likely to result.

If the fracture is open, stop the bleeding and treat the wound. Carefully straighten the injured leg. Apply a pneumatic splint if available; if not, apply **THREE** splints—one on each side of the leg and one underneath. Be sure that the splints are well padded, particularly under the knee and at the bones on each side of the ankle.

A pillow and two side splints work very well for treatment of a fractured lower leg. Place the pillow beside the injured leg, then carefully lift the leg and place it in the middle of the pillow. Bring the edges of the pillow around to the front of the leg and pin them together. Then place one splint on each side of the leg, over the pillow, and fasten them in place with strips of bandage or adhesive tape. Treat the victim for shock and evacuate as soon as possible. When available, you may use the Hare or Thomas half-ring traction splints.

#### Fracture of the Kneecap

The following first aid treatment should be given for a fractured kneecap (patella):

Carefully straighten the injured limb. Immobilize the fracture by placing a padded board under the injured limb. The board should be at least 4 inches wide and should reach from the buttock to the heel. Place extra padding under the knee and just above the heel, as shown in figure 4-56. Use strips of bandage to fasten the leg to the board in four places: (1) just below the knee; (2) just above the knee; (3) at the ankle; and (4) at the thigh. **DO NOT COVER THE KNEE ITSELF.** Swelling is likely to occur very rapidly,

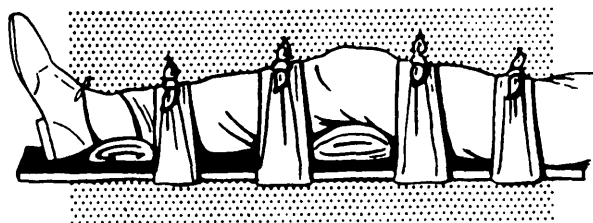


Figure 4-56.—Immobilization of a fractured patella.

136.24A

and any bandage or tie fastened over the knee would quickly become too tight. Treat the victim for shock and evacuate as soon as possible.

#### Fracture of the Clavicle

A person with a fractured clavicle usually shows definite symptoms. When the victim stands, the injured shoulder is lower than the uninjured one. The victim is usually unable to raise the arm above the level of the shoulder and may attempt to support the injured shoulder by holding the elbow of that side in the other hand; this is the characteristic position of a person with a broken clavicle. Since the clavicle lies immediately under the skin, you may be able to detect the point of fracture by the deformity and localized pain and tenderness.

If the fracture is open, stop the flow of blood and treat the wound before attempting to treat the fracture. Then apply a sling and swathe splint as described below:

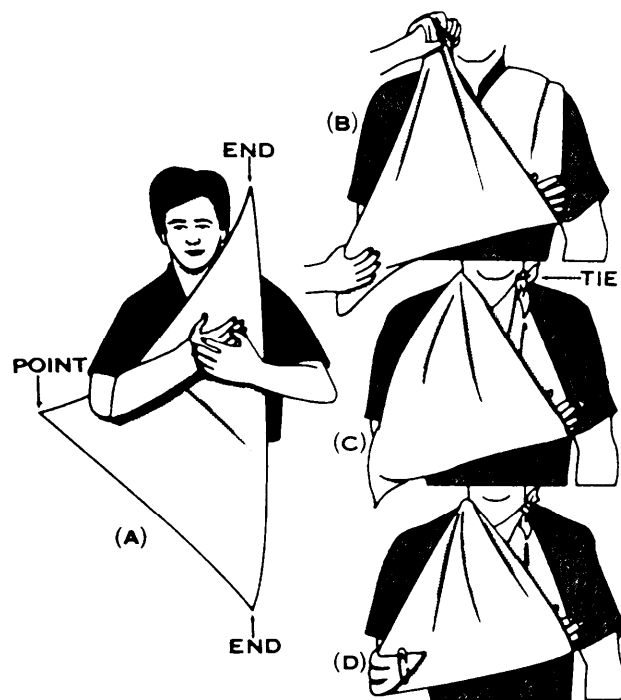
Bend the victim's arm on the injured side, and place the forearm across the chest. The palm of the hand should be turned in, with the thumb pointed up. The hand should be raised about 4

inches above the level of the elbow. Support the forearm in this position by means of a wide sling (fig. 4-57). A wide roller bandage (or any wide strip of cloth) may be used to secure the victim's arm to the body (see figure 4-53). A figure-of-eight bandage may also be used for a fractured clavicle. Treat the victim for shock and evacuate to a definitive care facility as soon as possible.

### Fracture of the Rib

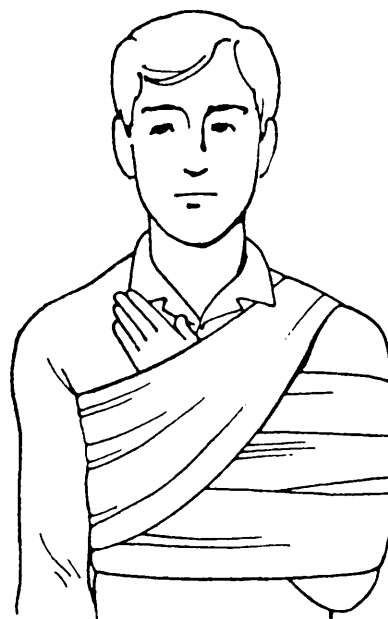
If the ribs are broken, make the victim comfortable and quiet so that the greatest danger—the possibility of further damage to the lungs, heart, or chest wall by the broken ends—is minimized.

The common finding in all victims with fractured ribs is pain localized at the site of the fracture. By asking the patient to point out the exact area of the pain, you can often determine the location of the injury. There may or may not be a rib deformity, chest wall contusion, or laceration of the area. Deep breathing, coughing, or movement is usually painful. The patient generally wishes to remain still and may often lean toward the injured side, with a hand over the fractured area to immobilize the chest and to ease the pain.



154.156

Figure 4-57.—Sling for immobilizing fractured clavicle.



136.25A

Figure 4-58.—Swathe bandage of fractured rib victim.

Ordinarily, rib fractures are not bound, strapped, or taped if the victim is reasonably comfortable. However, they may be splinted by the use of external support. If the patient is considerably more comfortable with the chest immobilized, the best method is to use a swathe (fig. 4-58) in which the arm on the injured side is strapped to the chest to limit motion. Place the arm on the injured side against the chest, with the palm flat, thumb up, and the forearm raised to a 45° angle. Immobilize the chest, using wide strips of bandage to secure the arm to the chest.

Wide strips of adhesive plaster applied directly to the skin of the chest for immobilization should not be used since the adhesive tends to limit the ability of the chest to expand and this interferes with proper breathing. Treat the victim for shock and evacuate as soon as possible.

### Fracture of the Nose

A fracture of the nose usually causes localized pain and swelling, a noticeable deformity of the nose, and extensive nosebleed.

Stop the nosebleed. Have the victim sit quietly, with the head tipped slightly backward. Tell the victim to breathe through the mouth and not to blow the nose. If the bleeding does not stop within a few minutes, apply a cold compress or an ice bag over the nose.

Treat the victim for shock and see that he or she receives a medical officer's attention as soon as possible. Permanent deformity of the nose may result if the fracture is not treated promptly.

### Fracture of the Jaw

A person who has a fractured jaw may suffer serious interference with breathing. There is likely to be great difficulty in talking, chewing, or swallowing. Any movement of the jaw causes pain. The teeth may be out of line, and there may be bleeding from the gums. Considerable swelling may develop.

One of the most important phases of emergency care is to clear the upper respiratory passage of any obstruction. If the fractured jaw interferes with breathing, pull the lower jaw and the tongue well FORWARD and keep them in that position.

Apply a four-tailed bandage, as shown in figure 4-59. Be sure that the bandage pulls the lower jaw FORWARD. Never apply a bandage that forces the jaw backward, since this might seriously interfere with breathing. The bandage must be firm so that it will support and immobilize the injured jaw, but it must not press against the victim's throat. Be sure that the victim has scissors or a knife to cut the bandage in case of vomiting. Treat the victim for shock and evacuate as soon as possible.

### Fracture of the Skull

When a person suffers a head injury, the greatest danger is that the brain may be severely damaged; whether or not the skull is fractured is

a matter of secondary importance. In some cases, injuries that fracture the skull do not cause serious brain damage; but brain damage can, and frequently does, result from apparently slight injuries that do not cause damage to the skull itself.

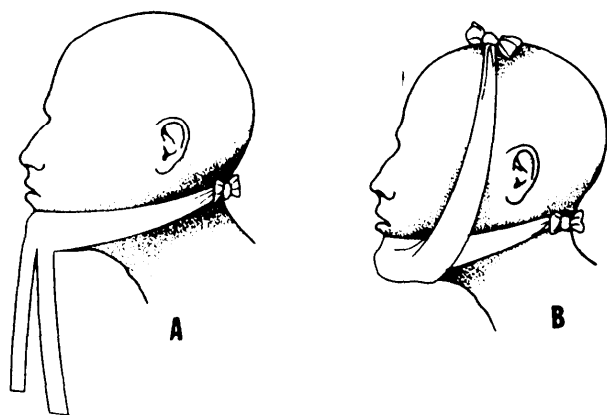
It is often difficult to determine whether an injury has affected the brain because the symptoms of brain damage vary greatly. A person suffering from a head injury must be handled very carefully and given immediate medical attention.

Some of the symptoms that may indicate brain damage are listed below. However, you must remember that all of these symptoms are not always present in any one case and that the symptoms that do occur may be greatly delayed.

1. Bruises or wounds of the scalp may indicate that the victim has sustained a blow to the head. Sometimes the skull is depressed (caved in) at the point of impact. If the fracture is open, you may find glass, shrapnel, or other objects penetrating the skull.
2. The victim may be conscious or unconscious. If conscious, the victim may feel dizzy and weak, as though about to faint.
3. Severe headache sometimes (but not always) accompanies head injuries.
4. The pupils of the eyes maybe unequal in size and may not react normally to light.
5. There may be bleeding from the ears, nose, or mouth.
6. The victim may vomit.
7. The victim may be restless and perhaps confused and disoriented.
8. The arms, legs, face, or other parts of the body may be partially paralyzed.
9. The victim's face may be very pale, or it may be unusually flushed.
10. The victim is likely to be suffering from shock, but the symptoms of shock may be disguised by other symptoms.

It is not necessary to determine whether or not the skull is fractured when you are giving first aid to a person who has suffered a head injury. The treatment is the same in either case, and the primary intent is to prevent further damage to the brain.

Keep the victim lying down. If the face is flushed, raise the head and shoulders slightly. If the face is pale, have the victim lie so that the head is level with, or slightly lower than, the body. Watch carefully for vomiting. If the victim begins to vomit, position the head to prevent choking on the vomitus.



136.26

Figure 4-59.—Four-tailed bandage for the jaw.

If there is serious bleeding from the wounds, try to control it by the application of direct pressure, using caution to avoid further injury to the skull or brain. Use a donut shaped bandage to gently surround protruding objects. Never manipulate those objects.

1. Be very careful about moving or handling the victim. Move the victim no more than is necessary. If transportation is necessary, keep the victim lying down.
2. In any significant head or facial injury, assume injury to the cervical spine. Immobilization of the cervical spine is indicated.
3. Be sure that the victim is kept comfortably warm, but not too warm.
4. Do NOT give the victim anything to drink. DO NOT GIVE ANY MEDICINES. See that the victim receives a medical officer's attention as soon as possible.

### Fracture of the Spine

If the spine is fractured at any point, the spinal cord may be crushed, cut, or otherwise damaged so severely that death or paralysis will result. However, if the fracture occurs in such a way that the spinal cord is not seriously damaged, there is a very good chance of complete recovery—PROVIDED the victim is properly cared for. Any twisting or bending of the neck or back, whether due to the original injury or carelessness from handling later, is likely to cause irreparable damage to the spinal cord.

The primary symptoms of a fractured spine are pain, shock, and paralysis. PAIN is likely to be acute at the point of fracture. It may radiate to other parts of the body. SHOCK is usually severe, but (as in all injuries) the symptoms may be delayed for some time. PARALYSIS occurs if the spinal cord is seriously damaged. If the victim cannot move the legs, feet, or toes, the fracture is probably in the back; if the fingers will not move, the neck is probably broken. Remember that a spinal fracture does not always injure the spinal cord, so the victim is not always paralyzed. Any person who has an acute pain in the back or the neck following an injury should be treated as though there is a fractured spine, even if there are no other symptoms.

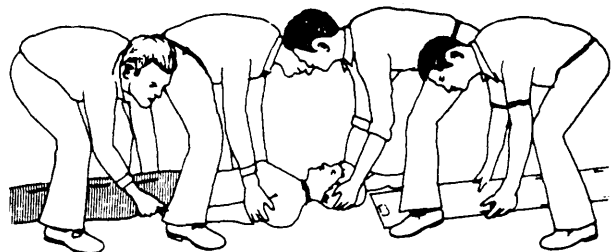
First aid treatment for all spinal fractures, whether of the neck or of the back, has two primary purposes: (1) to minimize shock and (2) to prevent further injury to the spinal cord. Keep the victim comfortably warm. Do not attempt to keep the victim in the position ordinarily used for the

treatment of shock, because it might cause further damage to the spinal cord. Just keep the victim lying flat and do **NOT** attempt to lower the head.

To avoid further damage to the spinal cord, **DO NOT MOVE THE VICTIM UNLESS IT IS ABSOLUTELY ESSENTIAL.** If the victim's life is threatened in the present location or transportation is necessary to receive medical attention, then of course you must move the victim. However, if movement is necessary, be sure that you do it in a way that will cause the least possible damage. **DO NOT BEND OR TWIST THE VICTIM'S BODY, DO NOT MOVE THE HEAD FORWARD, BACKWARD, OR SIDEWAYS, AND DO NOT UNDER ANY CIRCUMSTANCES ALLOW THE VICTIM TO SIT UP.**

If it is necessary to transport a person who has suffered a fracture of the spine, follow these general rules:

1. If the spine is broken at the NECK, the victim must be transported lying on the back, FACE UP. Place pillows or sandbags beside the head so that it cannot turn to either side. Do NOT put pillows or padding under the neck or head.
2. If you suspect that the spine is fractured but do not know the location of the break, treat the victim as though the neck is broken—i.e., keep the victim supine. If both the neck and the back are broken, keep the victim supine.
3. No matter where the spine is broken, USE A FIRM SUPPORT IN TRANSPORTING THE VICTIM. Use a rigid stretcher, or a door, shutter, wide board, etc. Pad the support carefully and put blankets both under and over the victim. Use cravat bandages or strips of cloth to secure the victim firmly to the support.



154.157  
Figure 4-60.—Moving spinal cord injury victim onto a backboard.

4. When placing the victim on a spine board, one of two acceptable methods may be used. However, **DO NOT ATTEMPT TO LIFT THE VICTIM UNLESS YOU HAVE ADEQUATE ASSISTANCE.** Remember, any bending or twisting of the body is almost sure to cause serious damage to the spinal cord. Figure 4-60 shows the straddle-slide method. One person lifts and

supports the head while a person at the shoulders and one at the hips lifts. A fourth person slides the spine board under the patient. Figure 4-61 shows the logroll method. The victim is rolled as a single unit towards the rescuers, the spine board is positioned, and the victim is rolled back onto the spine board and secured in place. If there are at least four (preferable six) people present to

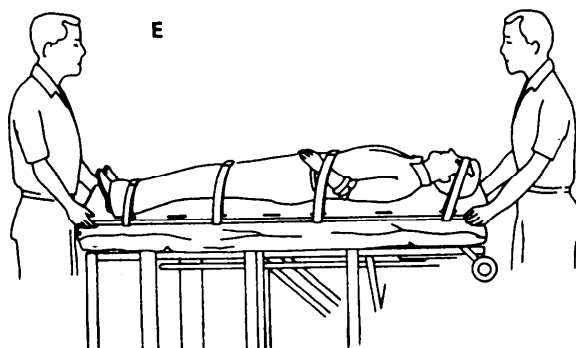
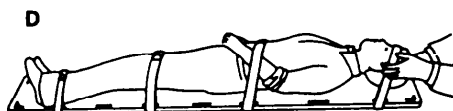
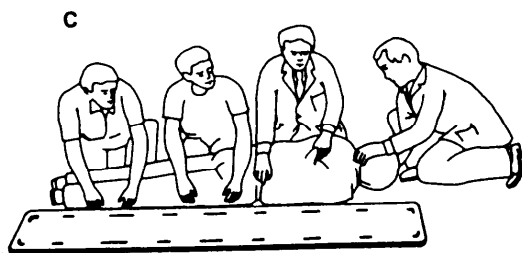
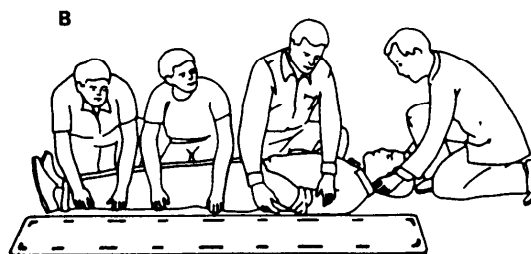
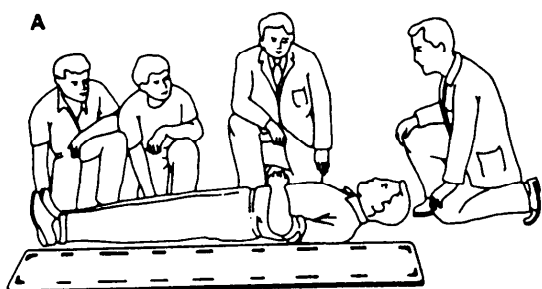


Figure 4-61.—Moving spinal cord injury victim onto a backboard using the logroll method.

- help lift the victim, they can accomplish the job without too much movement of the victim's body, but a smaller number of people should NEVER attempt to lift the victim.
5. Evacuate the victim very carefully.

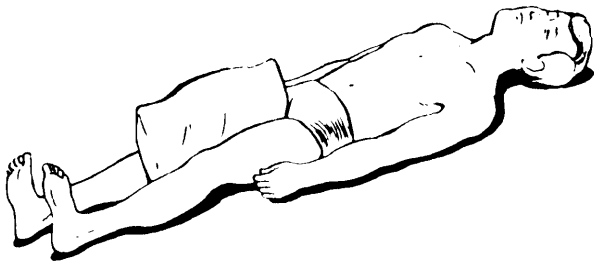
### Fracture of the Pelvis

Fractures in the pelvic region often result from falls, heavy blows, and accidents that involve crushing. The great danger in a pelvic fracture is the organs enclosed and protected by the pelvis may be seriously damaged when the bony structure is fractured. In particular, there is danger that the bladder will be ruptured. There is also danger of severe internal bleeding; the large blood vessels in the pelvic region may be torn or cut by fragments of the broken bone.

The primary symptoms of a fractured pelvis are severe pain, shock, and loss of ability to use the lower part of the body. The victim is unable to sit or stand. If the victim is conscious, there may be a sensation of "coming apart." If the bladder is injured, the victim's urine may be bloody.

Do not move the victim unless ABSOLUTELY necessary. The victim should be treated for shock and kept warm but should not be moved into the position ordinarily used for the treatment of shock.

If you must transport the victim to another place, do it with the utmost care. Use a rigid stretcher, a padded door, or a wide board. Keep the victim supine. In some cases, the victim will be more comfortable if the legs are straight while in other cases the victim will be more comfortable with the knees bent and the legs drawn up. When you have placed the victim in the most comfortable position, immobilization should be accomplished. Fractures of the hip are best treated with traction splints. Adequate immobilization



154.158  
Figure 4-62.—Immobilizing a fractured pelvis.

can also be obtained by placing pillows or folded blankets between the legs as shown in figure 4-62 and using cravats, roller bandages, or straps to hold the legs together, or through the use of MAST garments. Fasten the victim securely to the stretcher or improvised support and evacuate very carefully.

### INJURIES TO JOINTS AND MUSCLES

Injuries to joints and muscles often occur together, and sometimes it is difficult to tell whether the primary injury is to a joint or to the muscles, tendons, blood vessels, or nerves near the joint. Sometimes it is difficult to distinguish joint or muscle injuries from fractures. In case of doubt, ALWAYS treat any injury to a bone, joint, or muscle as though it were a fracture.

In general, joint and muscle injuries may be classified under four headings: (1) dislocations, (2) sprains, (3) strains, and (4) contusions (bruises).

#### Dislocations

When a bone is forcibly displaced from its joint, the injury is known as a DISLOCATION. In some cases, the bone slips back quickly into its normal position, but in other cases it becomes locked in the new position and remains dislocated until it is put back into place. Dislocations are usually caused by falls or blows but occasionally by violent muscular exertion. The most frequently dislocated joints are those of the shoulder, hip, fingers, and jaw.

A dislocation is likely to bruise or tear the muscles, ligaments, blood vessels, tendons, and nerves near a joint. Rapid swelling and discoloration, loss of ability to use the joint, severe pain and muscle spasms, possible numbness and loss of pulse below the joint, and shock are characteristic symptoms of dislocations. The fact that the injured part is usually stiff and immobile, with marked deformation at the joint, will help you distinguish a dislocation from a fracture. In a fracture, there is deformity BETWEEN joints rather than AT joints, and there is generally a wobbly motion of the broken bone at the point of fracture.

As a general rule, you should NOT attempt to reduce a dislocation—that is, put a dislocated bone back into place—unless you know that a medical officer cannot be reached within 8 hours. Unskilled attempts at reduction may cause great damage to nerves and blood vessels or actually

fracture the bone. Therefore, except in great emergencies, you should leave this treatment to specially trained medical personnel and concentrate your efforts on making the victim as comfortable as possible under the circumstances.

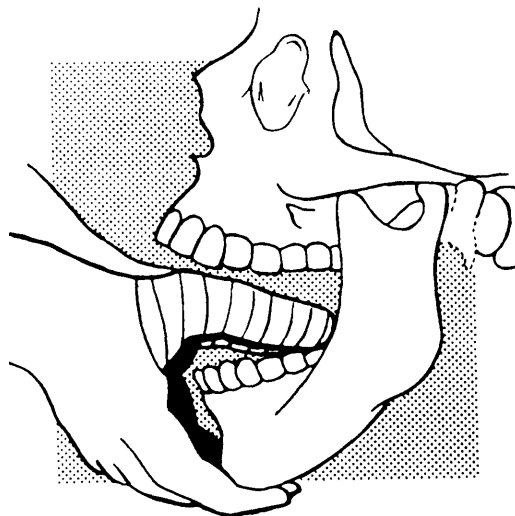
The following first aid measures will be helpful:

1. Loosen the clothing around the injured part.
2. Place the victim in the most comfortable position possible.
3. Support the injured part by means of a sling, pillows, bandages, splints, or any other device that will make the victim comfortable.
4. Treat the victim for shock.
5. Get medical help as soon as possible.

You should NEVER attempt to reduce the more serious dislocations, such as those of the hip. However, if it is probable that the victim cannot be treated by a medical officer within a REASONABLE TIME, you should make a careful effort to reduce certain dislocations, such as those of the jaw, finger, or shoulder IF there is no arterial or nerve involvement (pulse is palpable and there is no numbness below the joint). Treat all other dislocations as fractures, and evacuate the victim to a definitive care facility.

**DISLOCATION OF THE JAW.**— When the lower jaw is dislocated, the victim cannot speak or close the mouth. Dislocation of the jaw is usually caused by a blow to the mouth; sometimes it is caused by yawning or laughing. This type of dislocation is not always easy to reduce, and there is considerable danger that the operator's thumbs will be bitten in the process. For your own protection, wrap your thumbs with a handkerchief or bandage. While facing the victim, press your thumbs down just behind the last lower molars and, at the same time, lift the chin up with your fingers. The jaw should snap into place at once; you will have to remove your thumbs quickly in order to avoid being bitten. No further treatment is required, but you should warn the victim to keep the mouth closed as much as possible during the next few hours. Figure 4-63 shows the position you must assume to reduce a dislocated jaw.

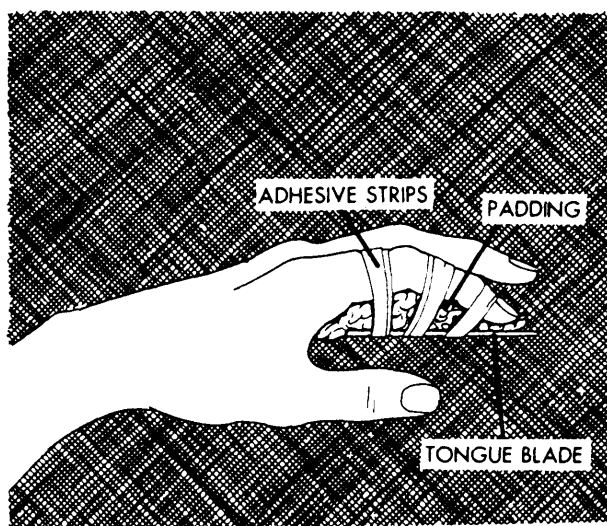
**DISLOCATION OF THE FINGER.**— The joints of the finger are particularly susceptible to injury, and even minor injuries may result in



136.29  
Figure 4-63.—Position for reducing a dislocated jaw.

prolonged loss of function. Great care must be used in treating any injury of the finger.

To reduce a dislocation of the finger, grasp the finger firmly and apply a steady pull in the same line as the deformity. If it does not slip into position, try it again, but if it does not go into position on the third attempt, DO NOT TRY AGAIN. In any case, whether or not the dislocation is reduced, the finger should be strapped, slightly flexed, with an aluminum splint or with a roller gauze bandage over a tongue blade. Figure 4-64 shows how a dislocated finger can be



136.30  
Figure 4-64.—Immobilizing a dislocated finger.

immobilized by strapping it to a flat, wooden stick, such as a tongue depressor.

#### **DISLOCATION OF THE SHOULDER.—**

Before reduction, place the victim in a supine position. After putting the heel of your foot in the victim's armpit, grasp the wrist and apply steady traction by pulling gently and increasing resistance gradually. Pull the arm in the same line as it is found. After several minutes of steady pull, flex the victim's elbow slightly. Grasp the arm below the elbow, apply traction from the point of the elbow, and gently rotate the arm into the external or outward position. If three reduction attempts fail, carry the forearm across the chest and apply a sling and swathe. An alternate method involves having the patient lie face down on an examining table with the injured arm hanging over the side. Apply prolonged, firm, gentle traction at the wrist with gentle external rotation. A water bucket with a padded handle placed in the crook of the patient's elbow may be substituted. Gradually add sand or water to the bucket to increase traction. Grasping the wrist and using the elbow as a pivot point, gently rotate the arm into the external position.

#### **Sprains**

A **SPRAIN** is an injury to the ligaments and soft tissues that support a joint. A sprain is caused by the violent wrenching or twisting of the joint beyond its normal limits of movement and usually involves a momentary dislocation, with the bone slipping back into place of its own accord. Although any joint may be sprained, sprains of the ankle, wrist, knee and finger are most common.

Symptoms of a sprain include pain or pressure at the joint, pain upon movement, swelling and tenderness, possible loss of movement, and discoloration. Treat all sprains as fractures until ruled out by x-rays.

Emergency care for a sprain includes application of cold packs for the first 24 to 48 hours to reduce swelling and to control internal hemorrhage; elevation and rest of the affected area; application of a snug, smooth, figure-of-eight bandage to control swelling and to provide immobilization (basket weave adhesive bandages can be used on the ankle); a follow-up examination by a medical officer; and x-rays to rule out the presence of a fracture. Note: Check bandaged areas regularly for swelling that might cause circulation impairment and loosen bandages if

necessary. After the swelling stops (24 to 48 hours) moist heat can be applied for short periods (15 to 30 minutes) to promote healing and to reduce swelling. Moist heat can be warm, wet compresses, warm whirlpool baths, etc. **CAUTION:** Heat should not be applied until 24 hours after the last cold pack.

#### **Strains**

An injury caused by the forcible overstretching or tearing of a muscle or tendon is known as a **STRAIN**. Strains may be caused by lifting excessively heavy loads, sudden or violent movements, or any other action that pulls the muscles beyond their normal limits.

The chief symptoms of a strain are pain, lameness or stiffness (sometimes involving knotting of the muscles), moderate swelling at the place of injury, discoloration due to the escape of blood from injured blood vessels into the tissues, possible loss of power, and a distinct gap felt at the site.

Keep the affected area elevated and at rest; apply cold packs for the first 24 to 48 hours to control hemorrhage and swelling; after the swelling stops, apply mild heat to increase circulation and aid in healing. As in sprains, heat should not be applied until 24 hours after the last cold pack. Muscle relaxants, adhesive straps, and complete immobilization of the area may be indicated. Evacuate the victim to a medical facility where x-rays can be taken to rule out the presence of a fracture.

#### **Contusion**

**CONTUSIONS**, commonly called **BRUISES**, are responsible for the discoloration that almost always accompanies injuries to bones, joints, and muscles. Contusions are caused by blows that damage bones, muscles, tendons, blood vessels, nerves, and other body tissues, although they do not necessarily break the skin.

The symptoms of a contusion or bruise are familiar to everyone. There is immediate pain when the blow is received. Swelling occurs because blood from the broken vessels oozes into the soft tissues under the skin. At first the injured place is reddened due to local skin irritation from the blow; later the characteristic "black and blue" marks appear; and finally, perhaps several days later, the skin is yellowish or greenish. The bruised area is usually very tender.

As a rule, slight bruises do not require treatment. However, if the victim has severe bruises,

treat for shock. Immobilize the injured part, keep it at rest, and protect it from further injury. Sometimes the victim will be more comfortable if the bruised area is bandaged firmly with an elastic or gauze bandage. If possible, elevate the injured part. A sling may be used for a bruised arm or hand. Pillows or folded blankets may be used to elevate a bruised leg.

## **POISONS AND DRUG ABUSE**

A poison is a substance that, when taken into the body, produces a harmful effect on normal body structures or functions. Poisons come in solid, liquid, and gaseous forms and may be ingested, inhaled, absorbed, or injected into the system. Children are most susceptible to toxic substances, but as a hospital corpsman you must also be prepared to respond to the accidental or intentional poisoning of adult victims. The handling of drug abuse cases will be covered at the end of this section.

### **OBTAINING INFORMATION**

As a general rule, your first contact, whether on the phone or in person with a suspected poisoning victim or the victim's relatives or friends, will be complicated by excitement, especially if you are dealing with a parent. It is absolutely essential that you be calm, professional, and systematic if you are to be able to elicit all the essential information you will need.

After maintenance of life support systems, the first priority is to identify the poison. If the poisoning was not witnessed, and if the victim cannot or will not identify the agent, it becomes necessary to obtain the container that held the poison. A commercial label on the container should identify the name of the product, the ingredients, and the antidote to any toxic substance it may contain. If there is no label or if you suspect that the container held an unidentified substance other than that listed on the side, send the container along with the victim to the hospital for laboratory analysis.

The second priority is to determine the quantity of poison taken. Once again, if the victim cannot or will not provide the information, the container must be checked. Whatever is not in the container is normally considered to be in the victim, unless someone familiar with the container can verify the quantity previously used.

The third priority is to determine as closely as possible the time the poisoning occurred. If it was not witnessed, careful questioning of bystanders and the victim may be needed to approximate the time.

The fourth priority is to establish as accurately as possible the victim's symptoms and medical history. The symptoms will give you a good idea of the severity of the poisoning and its progression. They will also give you a clue as to whether the victim has taken any additional poisons. The medical history can establish if this is a repeat poisoning and if the victim has any illnesses or is using medications that may contraindicate certain methods of treatment.

Quick systematic questioning will give basic information about the poison and the victim's condition. Additional information about the toxic ingredients of almost every commercial product, along with recommended antidotes and treatments, is readily available through poison control centers at medical treatment facilities throughout the country. Area centers are listed in the front of every telephone directory. Also, be familiar with your command's antidote locker and poison chart. With all this information in hand, a medical professional will be able to quickly assess the situation and plan and implement a course of treatment.

### **GENERAL TREATMENT**

In most situations, the treatment of a poisoning victim will be under the direction of a medical officer. However, in isolated situations, a hospital corpsman must be ready to treat the victim.

Poisoning should be suspected in all cases of sudden, severe, and unexpected illness. Once poisoning has been established, the general rule is to quickly remove as much of the toxic substance from the victim as possible. For most ingested poisons, there is a choice between emetics and gastric lavage, followed by absorbents and cathartics; for inhaled poisons, oxygen ventilation is the method of choice; for absorbed poisons, this primarily means cleansing the skin; and for injected poisons, antidotal medications are recommended.

### **INGESTED POISONS**

#### **Noncorrosives**

The many different noncorrosive substances have the common characteristic of irritating the

**Table 4-5.—Common stomach irritants and possible sources of contact**

<b>Irritant</b>	<b>Sources of Contact</b>
Arsenic	Dyes, insecticides, paint, printer's ink, wood preservatives
Copper	Antifoulant paint, batteries, canvas preservative, copper plating, electroplating, fungicides, insecticides, soldering, wood preservatives
Iodine	Antiseptics
Mercury	Bactericide, batteries, dental supplies and appliances, disinfectants, dyes, fungicides, ink, insecticides, laboratories, photography, wood preservatives
Phosphorus	Incendiaries, matches, pesticides, rat poison
Silver nitrate	Batteries, cleaning solutions, ink, photographic film, silver polish, soldering
Zinc	Disinfectants, electroplating, fungicides, galvanizing, ink, insecticides, matches, metal plating and cutting, paint, soldering, wood preservatives

stomach. They produce nausea, vomiting, convulsions, and severe abdominal pain. The victim may complain of a strange taste, and the lips, tongue, and mouth may look different than normal. Shock occurs in severe cases. Examples of noncorrosives are listed in table 4-5.

First aid for most forms of noncorrosive poisoning centers on quickly emptying the stomach of the irritating substance. The following steps are suggested:

1. Maintain an open airway. Be prepared to give artificial ventilation.
2. Dilute the poison by having the conscious victim drink one to two glasses of water or milk.

3. Empty the stomach, using emetics or gastric lavage.

- a. Giving an emetic is a preferred method for emptying the contents of the stomach. It is quick and can be used in almost every situation when the victim is conscious, except in cases of caustic or petroleum distillate poisoning, or when an antiemetic has been ingested. In most situations, a hospital corpsman will have access to syrup of Ipecac, which can be given in a 15 ml (3 tsp) oral dose, repeated in 20 minutes if the first dose is nonproductive. In an emergency room the medical officer can rapidly induce vomiting by the injection of various medications. If nothing else is available, tickle the back of the victim's throat with your finger or a blunt object to induce vomiting.
- b. Trained personnel may use gastric lavage by itself, or after 2 doses of Ipecac syrup have failed to induce vomiting. After passing a large caliber nasogastric tube, aspirate the stomach contents. Next, instill 100 ml of normal saline into the stomach, then aspirate it out again. Continue this flushing cycle until the returning fluid is clear. Gastric lavage is preferred when the victim is unconscious, or subject to seizures, as in strychnine poisoning.

4. Collect the vomitus for laboratory analysis.
5. Soothe the stomach with milk or milk of magnesia.
6. Transport the victim to a definitive care facility if symptoms persist.

## Corrosives

Acids and alkalies produce actual chemical burning and corrosion of the tissues of the lips, mouth, throat, and stomach. Acids do most of their damage in the acidic stomach environment, while alkalies primarily destroy tissues in the mouth, throat and esophagus. Stains and burns around the mouth and the presence of characteristic odors provide clues to corrosive poisoning. Swallowing and breathing may be difficult, especially if any corrosive was aspirated into the lungs. The abdomen may be tender and swollen with gas. Examples of corrosive agents, and sources of contact are listed in table 4-6.

When providing treatment for the above poisons, **DO NOT INDUCE VOMITING**. The caustic damage to the mouth and esophagus will

**Table 4-6.-Examples of common acids, alkalis, and phenols with possible sources of contact**

AGENT	SOURCES OF CONTACT
ACIDS	
Hydrochloric	Electroplating, metal cleaners, photoengraving
Nitric	Industrial cleaners, laboratories, photoengraving, rocket fuels
Oxalic	Cleaning solutions, paint and rust removers, photo developer
Sulfuric	Auto batteries, detergents, dyes, laboratories, metal cleaners
ALKALIES	
Ammonia	Galvanizes, household cleaners, laboratories, pesticides, rocket fuels
Lime	Brick masonry, cement, electroplating, insecticides, soap, water treatment
Lye	Bleaches, degreasers, detergents, laboratories, paint and varnish removers
PHENOLS	
Carbolic	Disinfectants, dry batteries, paint removers, photo materials, wood preservatives
Creosol	Disinfectants, ink, paint and varnish removers, photo developer, stainers
Creosote	Asbestos, carpentry, diesel engines, electrical shops, furnaces, lens grinders, painters, water-proofing, wood preservatives

be compounded. In addition, the threat of aspiration during vomiting is too great. Gastric lavage could cause perforation of the esophagus or stomach, therefore, use it only on a doctor's order. First aid consists of diluting the corrosive and keeping alert for airway patency and shock. If spontaneous vomiting occurs, administer an antiemetic.

Controversy exists over the value of attempting to neutralize corrosives because of the exothermic (heat producing) reaction when acids and alkalis are mixed. Therefore, do not attempt to neutralize corrosives unless directed to do so by a physician. When neutralizing acids, use milk of magnesia following dilution. **DO NOT** use carbonates; they generate carbon dioxide gas which may cause perforation. When neutralizing alkalis, use a dilute solution of vinegar in water. Transport all poisoning patients to a medical treatment facility for evaluation and further treatment.

#### **Petroleum Distillates**

Volatile petroleum products such as kerosene, gasoline, turpentine, and related petroleum products, such as red furniture polish, usually cause severe chemical pneumonia as well as other toxic effects in the body. Symptoms include abdominal pain, choking, gasping, vomiting, and fever. Often these products may be identified by their characteristic odor. Mineral oil and motor oil are not as serious, since they usually do nothing more than cause diarrhea.

When providing treatment for the ingestion of petroleum distillates, **DO NOT INDUCE VOMITING** unless told to do so by a physician or poison control center. Vomiting may cause additional poison to enter the lungs. However, the quantity of poison swallowed or special petroleum additives may make gastric lavage or the use of cathartics advisable.

1. If a physician or poison control center cannot be reached, give the victim 30 to 60 ml of vegetable oil.
2. Transport the victim immediately to a medical treatment facility.

#### **Shellfish and Fish Poisoning**

Mussels, clams, oysters, and other shellfish often become contaminated with bacteria during the warm months of March through November. Numerous varieties of shellfish should not be eaten at all, so wherever you serve in the world, learn which local seafoods are known to be safe.

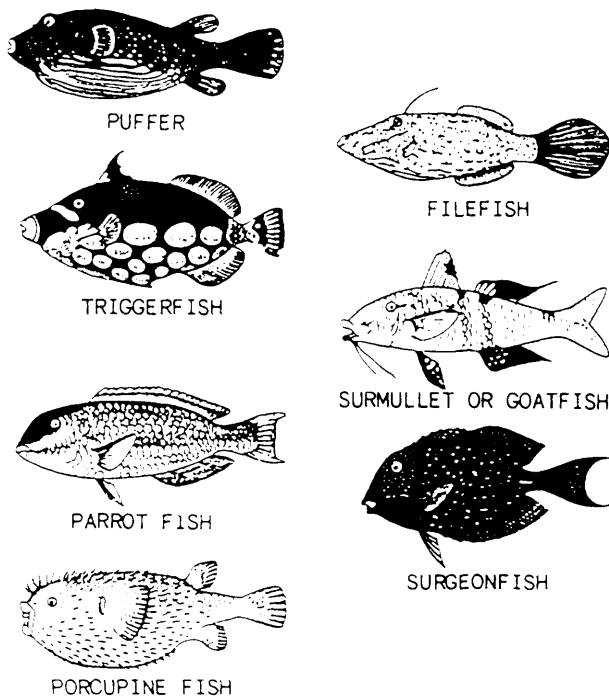


Figure 4-65.—Poisonous fish.

136.8A

Most fish poisoning occurs with fish that normally are considered safe to eat, but which become poisonous at different times of the year from eating poisonous algae and plankton (red tide) that appear in certain locations. Examples of fish that are always poisonous are shown in figure 4-65.

The symptoms of shellfish and fish poisoning are tingling and numbness of the face and mouth, muscular weakness, nausea and vomiting, increased salivation, difficulty in swallowing, and respiratory failure.

Primary treatment is directed toward evacuating the stomach contents; if the victim has not vomited, cause him or her to do so. Use syrup of Ipecac, gastric lavage, or manual stimulation; then administer a cathartic. If respiratory failure develops, give artificial ventilation and treat for shock.

## POISONS BY INHALATION

In the Navy, many industrial processes are carried out. The problem of poisoning by inhalation is widespread. The irritants and corrosives mentioned in tables 4-5 and 4-6 are more often a source of poisoning by means of inhalation rather

than by ingestion. The handling of large quantities of petroleum products (fuel oil and gasoline, in particular) constitutes a special hazard, since all of these products give off hazardous vapors.

Other poisonous gases are by-products of certain operations or processes: exhaust gases from internal combustion engines; fumes or vapors from materials used in casting, molding, welding, or plating; gases associated with bacterial decomposition in closed spaces; and gases that accumulate in voids, double bottoms, empty fuel tanks, and similar places. Carbon monoxide is the most common agent of gas poisoning. It is present in exhaust gases of internal combustion engines as well as in sewer gas, lanterns, charcoal grills, and in manufactured gas used for heating and cooking. It gives no warning of its presence since it is completely odorless and tasteless. The victim may lose consciousness and suffer respiratory distress with no warning other than slight dizziness, weakness, and headache. The lips and skin of a victim of carbon monoxide poisoning are characteristically cherry red. Death may occur within a few minutes. Some sources of inhalation chemical poisoning are listed in table 4-7.

Most inhalation poisoning causes shortness of breath and coughing. The victim's skin will turn blue. If the respiratory problems are not corrected, cardiac arrest may follow.

The first stage of treatment for an inhalation poisoning is to remove the victim from the toxic atmosphere immediately. **WARNING:** Never try to remove a victim from the toxic environment if you do not have the proper protective mask or breathing apparatus or if you are not trained in its use. Too often, well intentioned rescuers become victims. When in doubt, call for trained personnel. If help is not immediately available, and if you know you can reach and rescue the victim, take a deep breath, hold it, enter the area, and pull the victim out. Next:

1. Start basic life support as outlined in the first section of the chapter.
2. Remove or decontaminate the clothing if chemical warfare agents or volatile fuels were the cause.
3. Keep the victim quiet, treat for shock, and administer oxygen.
4. Transport the victim to a medical treatment facility for further treatment.

Table 4-7.—Sources of inhalation poisoning

Inhalant	Sources of Contact
Carbon dioxide	Wells and sewers
Carbon monoxide	Fires, lightning, heating and fuel exhausts
Carbon tetrachloride	Solvents in dry cleaning fluid, electrical equipment
Trichloroethylene	Cleaners, decreasing agents, and fire extinguishers
Chemical warfare agents	Tear, nerve, blister, and vomiting gases, screening smokes, thermite and magnesium incendiary substances, hydrocyanic acid, and other systemic poisons
Chlorine	Water purification
Ether, chloroform, nitrous oxide, cyclopropane, and freon	Ice making and refrigeration units

## ABSORBED POISONS

Some substances may cause tissue irritation or destruction by contact with the skin, eyes, and lining of the nose, mouth, and throat. These substances include acids, alkalies, phenols, and some chemical warfare agents. Direct contact with these substances will cause inflammation or chemical burns in the affected areas. Consult the “Chemical Burns” section of this chapter and the “Chemical Agents” section of chapter 12 of this manual for treatment.

## INJECTED POISONS

Injection of venom by stings and bites from various insects, while not normally life-threatening, can cause an acute allergic reaction that can be fatal. Poisons may also be injected by snakes and marine animals.

## Bee, Wasp, and Fire Ant Stings

Stings from bees, wasps, and ants account for more poisonings than stings from any other insect group. Fortunately, they rarely result in death. The vast majority of stings cause a minor local reaction of pain, redness, itching, and swelling at the injection site. These symptoms usually fade after a short time.

A small percent of these stings cause a severe anaphylactic reaction, presenting itching, swelling, weakness, headache, difficulty in breathing, and abdominal cramps. Shock may follow quickly and death may occur. The following first aid measures are recommended:

1. Closely monitor vital signs and remove all rings, bracelets, and watches.
2. Remove stingers by scraping with a dull knife (pulling forces venom remaining in the sac into the wound).
3. Place an ice cube or analgesic-corticosteroid lotion over the wound site to relieve pain.
4. For severe reactions, apply a constricting band above the injured site at the edge of the swelling. Advance it as needed.
5. For severe allergic reactions, immediately give the victim a subcutaneous injection of 1:1000 aqueous solution of epinephrine. Dosage ranges from 0.2 to 0.3 cc for children to 0.5 cc for adults.
6. Patients with severe allergic reactions should be evacuated to a medical facility.

## Scorpion Stings

The only North American scorpion of medical importance is the *Centruroides sculturatus* found in Mexico and certain areas of the American Southwest. Its sting causes severe pain and some weakness in the affected area. It may also cause vomiting, visual disturbances, and circulatory and respiratory depression. In some cases, a state of excitability may occur, with muscle spasms, and in severe cases, progression to a comatose state. The following first aid treatment should be given for scorpion stings:

1. Place ice over the sting site.
2. Morphine and meperidine hydrochloride are contraindicated as they potentate the venom.
3. Calcium gluconate 10 percent may be given intravenously to relieve muscle spasms.
4. Valium maybe used to control excitability and convulsions.

5. An antivenin is available for *Cenfruioides sculpturatus*.
6. Keep the victim under observation and be prepared to give symptomatic supportive care.

### Spider Bites

Spiders in the United States are generally harmless, with several exceptions. The most notable are the black widow and brown recluse spiders. Their bites are serious but rarely fatal.

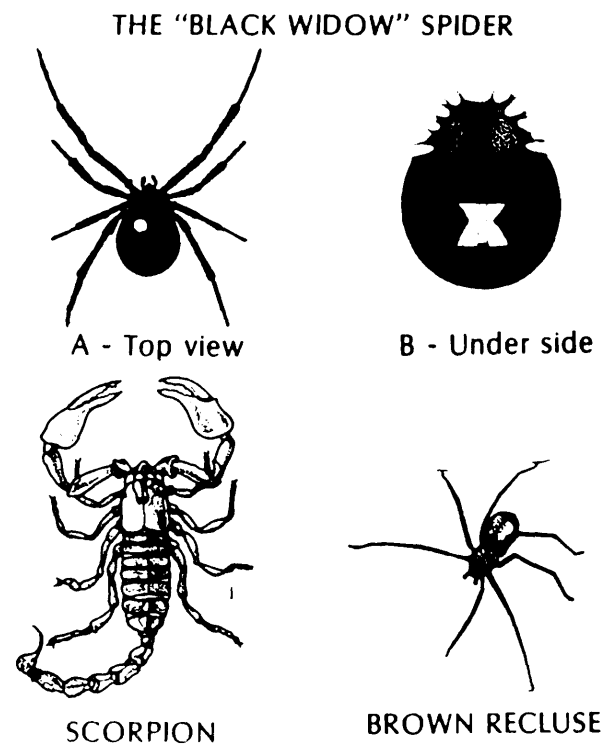
The female black widow spider is usually identified by the hourglass-shaped red spot on its belly (fig. 4-66). Its bite causes a dull, numbing pain, which gradually spreads from the region of the bite to the muscles of the entire torso. The pain becomes severe, and a board-like rigidity of the abdominal muscles is common. Nausea, vomiting, headache, dizziness, difficulty in breathing, edema, rash, hypertension, and anxiety are frequently present. The bite site can be very hard to locate, since there is little or no swelling at the site, and the victim may not be immediately aware of having been bitten. The buttocks and genitalia should be carefully examined for a bite site if the suspected victim has recently used an outside

latrine. The following first aid treatment steps are suggested:

1. Place ice over the bite to reduce pain.
2. Hospitalize victims who are under 16 or over 65 for observation.
3. Be prepared to give antivenin in severe cases.

The brown recluse spider (fig. 4-66) is identified by its violin-shaped marking. Its bite may initially go unnoticed, but after several hours a bleb develops over the site, and rings of erythema begin to surround the bleb. Other symptoms include skin rash, fever and chills, nausea and vomiting, and pain. A progressively enlarging necrotic ulcerating lesion eventually develops. Treatment for brown recluse spider bites includes the following:

1. Early diagnosis is important since, within the first 8 hours, a medical officer has the option of excising the lesion and starting corticosteroid therapy.
2. The lesion should be debrided, cleansed with peroxide, and soaked with Burow's solution three times daily.
3. Apply polymyxin-bacitracin-neomycin ointment, and cover the lesion with a sterile dressing.



### Snakebites

Poisonous snakes are found throughout the world, primarily in the tropical and temperate regions. Within the United States, there are 20 species of poisonous snakes. They can be grouped into two families, the Crotalidae (rattlesnakes, copperheads, and moccasins) and the Elapidae (coral snakes).

The Crotalidae are called pit vipers because of the small, deep pits between the nostrils and the eyes (fig. 4-67). They have two long hollow fangs, which normally are folded against the roof of the mouth, but which can be extended by a swivel mechanism when they strike. Other identifying features include thick bodies, slitlike pupils of the eyes, and flat triangular heads. Further identification is provided by examining the wound for signs of fang entry in the bite pattern shown in figure 4-67. Individual identifying characteristics include audible rattles on the tails of most rattlesnakes, and the cotton white interior of the mouths of moccasins. These snakes are found in every state except Maine, Alaska, and Hawaii.

Coral snakes are related to the cobra, kraits, and mamba snakes in other areas of the world (fig. 4-68). Corals, which are found in the

136.68

Figure 4-66.—Black widow and brown recluse spiders and scorpion.

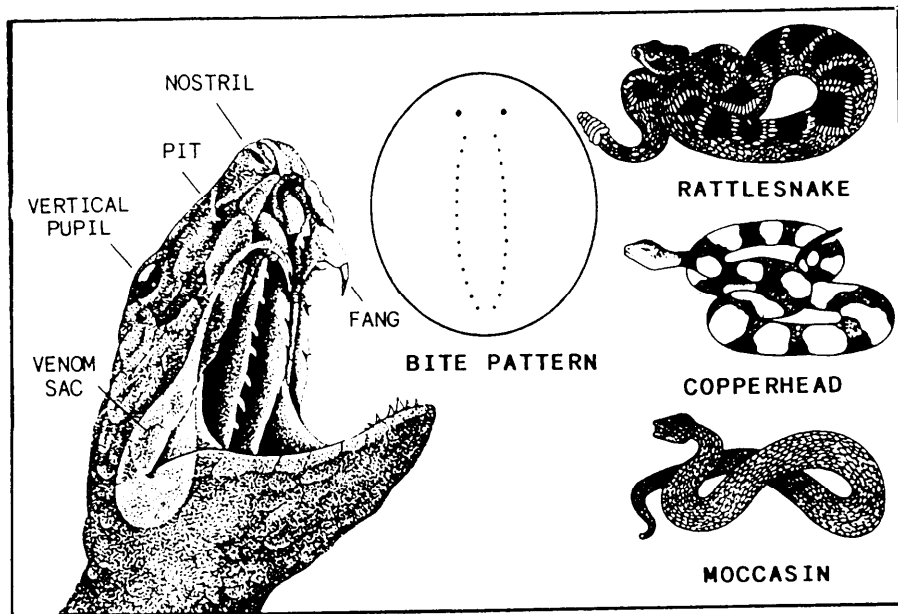


Figure 4-67.-American pit vipers.

136.70

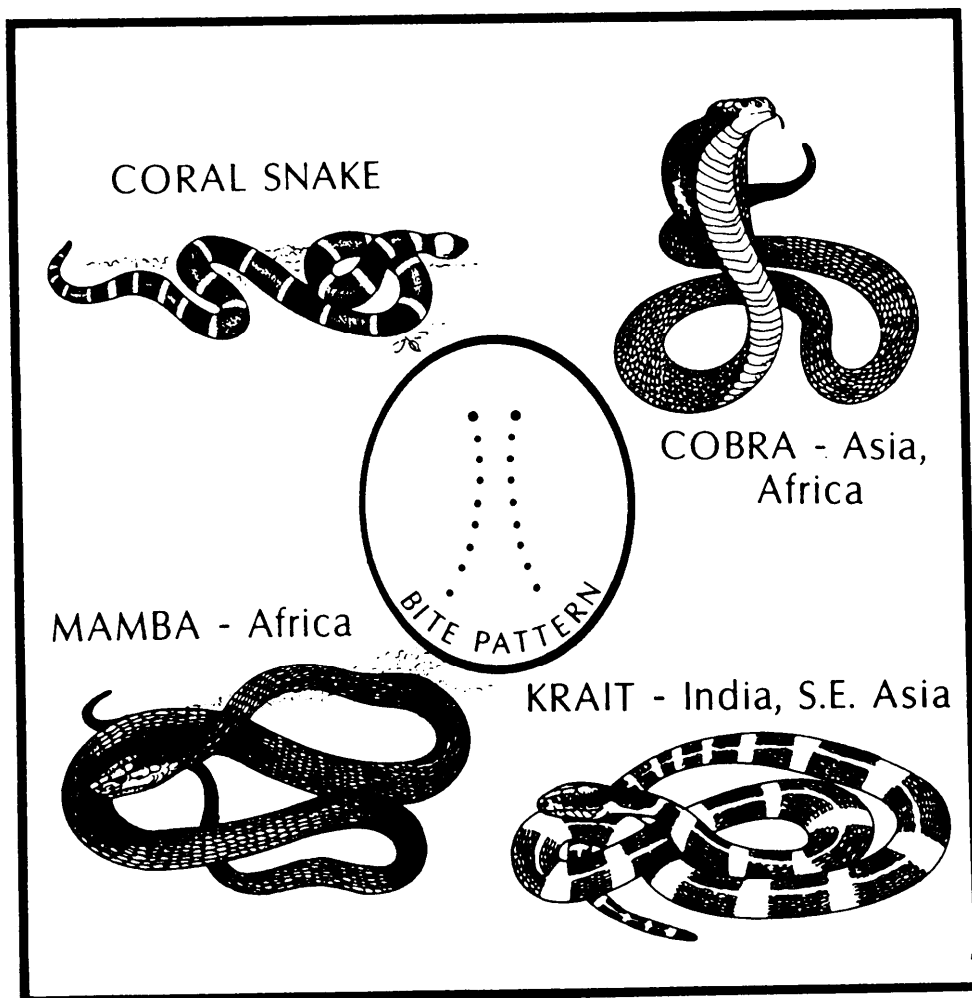


Figure 4-68.—Corals, cobras, kraits, and mambas.

136.71

Southeastern United States, are comparatively thin snakes with small bands of red, black, and yellow (or almost white). Some nonpoisonous snakes have the same coloring, but in the coral snake the red band always touches the yellow band. Its short, grooved fangs must chew into its victim before the poison can be introduced. The bite pattern is shown in figure 4-68. In a snakebite situation, every reasonable effort should be made to kill or at least to positively identify the culprit, since treatment of a nonpoisonous bite is far simpler and less dangerous to the victim than treatment of a poisonous bite.

Snake venom is a complex mixture of enzymes, peptides, and other substances. A single injection can cause many different toxic effects in many areas of the body. Some of these effects are felt immediately while the action of other venom components may be delayed for hours or even days. A poisonous bite should be considered a true medical emergency until symptoms prove otherwise.

The venom is stored in sacs in the snake's head. It is introduced into a victim through hollow or grooved fangs. An important point to remember, however, is that a bitten patient has not necessarily received a dose of venom. The snake can control whether or not it will release the poison and how much it will inject. As a result, while symptoms in a poisonous snakebite incident may be severe, they may also be mild or not develop at all.

It is essential that you be able to quickly diagnose a snakebite as being envenomated or not.

Usually enough symptoms present themselves within an hour of a poisonous snakebite to erase any doubt. The victim's condition provides the best information as to the seriousness of the situation. The bite of the pit viper is extremely painful and is characterized by immediate swelling and edema about the fang marks, usually within 5 to 10 minutes, spreading and possibly involving the whole extremity within an hour. If only minimal swelling occurs within 30 minutes, the bite will almost certainly have been from a nonpoisonous snake or from a poisonous snake that did not inject venom. When the venom is absorbed, there is general discoloration of the skin due to the destruction of blood cells. This reaction is followed by blisters and numbness in the affected area. Other signs that may occur are weakness,

rapid pulse, nausea, shortness of breath, vomiting, shock, headache, fever, chills, drop in blood pressure, and blurred vision. Severe poisoning can cause pulmonary edema and internal bleeding. The eastern diamondback rattler bite is further characterized by numbness and tingling of the mouth and possibly also of the face and scalp. A metallic taste on the tongue may be noted.

The aim of first aid for envenomated snakebites is to reduce the circulation of blood through the bite area, delay absorption of venom, prevent aggravation of the local wound, maintain vital signs, and transport the victim as soon as possible to a medical treatment facility. Other aid will be mainly supportive:

1. Apply a constricting band (i.e., rubber tubing, belt, necktie, stocking) above and below the bite. Each band should be approximately 2 inches from the wound, but NEVER place the bands on each side of a joint. If only one constricting band is available, place it above the wound. It should be tight enough to stop the flow of blood in the veins, but not tight enough to shut off the arterial blood supply. The victim's pulse should be palpable below the band. Advance the constricting band to keep ahead of the swelling.
2. If the victim cannot reach a medical treatment facility within 30 minutes of the time of the bite, and there are definite signs of poisoning, use a sterile knife blade to make an incision about 1/2 inch long and 1/4 inch deep over each fang mark on the long axis of the extremity. This technique is done only on the extremities, not on the head or trunk. Apply suction cups to help remove some of the injected venom. Suction by mouth is recommended only as a last resort, because the human mouth contains so many different bacteria that the bite could become infected. Incision and suction later than 30 minutes from the time of the bite is not recommended.
3. Check the pulse and respiration frequently. Give artificial ventilation if necessary.
4. Calm and reassure the victim, who will often be excited or hysterical. Keep the victim

lying down, quiet, and warm. DO NOT give alcohol or any other stimulant to drink.

5. Treat for shock.
6. Use a splint to immobilize the victim's affected extremity, keeping the involved area at or below the level of the heart.
7. Cover the wound to prevent further contamination.
8. Give aspirin for pain.
9. Telephone the nearest medical facility so that the proper antivenin can be made available.
10. Transport the victim (and the dead snake) to a medical treatment facility as soon as possible. All suspected snake bite victims should be taken to the hospital, whether they show signs of envenomation or not.

Treatment of a nonenvenomated snakebite is essentially the same as the treatment for puncture wounds.

In most situation, the definitive care of the victim will be in the hands of a medical officer. This care will center around the use of antivenin serum. All western hemisphere snakes, with the exception of the eastern coral snake, can be treated with the same polyvalent antivenin. This is given in doses of 3 vials for small reactions; 5 to 8 vials for cases in which there is swelling of a hand or foot; and at least 8 vials for moderate or severe envenomation. Extra vials are kept at the ready. Children will receive higher doses than adults since the poison has more effect on them because of their smaller size and lower weight.

Because the antivenin is a horse serum base, the medical officer will order a sensitivity test before it is given. Routine laboratory tests will also be run in preparation for the possible start of whole blood infusion.

Additional medical facility care would include tetanus prophylaxis, wound cleansing and debridement, Burow's solution soaks, antiseptic ointment, and sterile dressing.

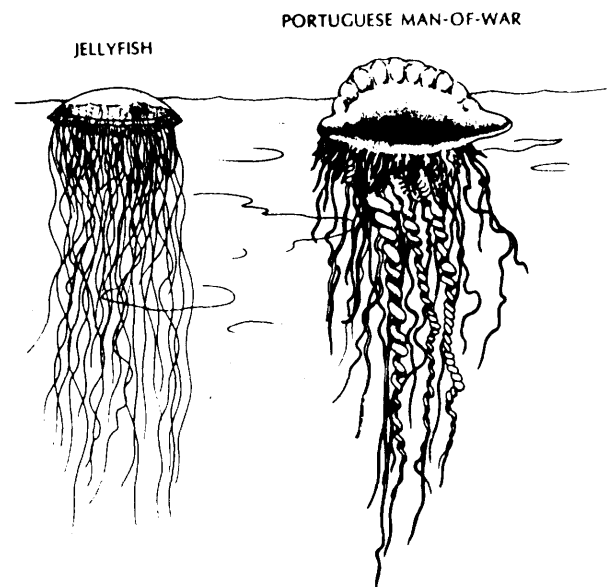
### Bites, Stings, and Punctures from Sea Animals

A number of sea animals are capable of inflicting painful wounds by biting, stinging, or

puncturing. Except under rare circumstances, these stings and puncture wounds are not fatal. Major wounds from sharks, barracuda, moray eels, and alligators can be treated by controlling the bleeding, preventing shock, giving basic life support, splinting the injury, and transporting the victim to a medical treatment facility. Minor injuries inflicted by turtles and stinging corals require only that the wound be thoroughly cleansed and the injury splinted.

Other sea animals inflict injury by means of stinging cells located in tentacles. This group includes the jellyfish and Portuguese man-of-war (fig. 4-69). Contact with the tentacles produces burning pain, a rash with small hemorrhage in the skin, and, on occasion, shock, muscular cramping, nausea, vomiting, and respiratory distress. Treatment consists of pouring sea water over the injured area and then removing the tentacles with a towel or gloves. Next, pour rubbing alcohol, formalin, vinegar, or diluted ammonia over the affected area to neutralize any remaining nematocysts (minute stinging structures). Finally, cover the area with a dry powder, to which the last nematocysts will adhere, and then scrape them off with a dull knife.

Spiny fish, stingrays, urchins, and cone shells inject their venom by puncturing with spines



136.72  
Figure 4-69.—Jellyfish and Portuguese Man-of-war.



Figure 4-70.—Stingray sting.

136.73

(fig. 4-70). General signs and symptoms include swelling, nausea, vomiting, generalized cramps, diarrhea, muscular paralysis, and shock. Emergency care consists of prompt flushing with cold sea water to remove the venom and to constrict hemorrhaging blood vessels. Next, debride the wound of any remaining pieces of the spine's venom-containing integumentary sheath. Soak the wound area in very hot water for 30 to 60 minutes to neutralize the venom. Finally, completely debride the wound, control hemorrhage, suture, provide tetanus prophylaxis and a broad-spectrum antibiotic, and elevate the extremity.

Sea snakes are found in the warm water areas of the Pacific and Indian Oceans. Their venom is VERY poisonous, but their fangs are only 1/4 inch long. It is advisable to follow the first aid steps outlined for the treatment of land snakebites.

## DRUG ABUSE

Drug abuse is the habitual or excessive use of drugs for purposes or in quantities for which they were not intended.

Drugs are chemical compounds or biological substances that, when introduced into the body, affect its mental or physical functions. When abused, drugs become a source of "poison" to

the body. They can lead to serious illness, dependency, and death. Death is usually due to acute intoxication or overdose.

The group classification used in this manual is intended to categorize drugs most commonly abused into useful clusters. For our purposes, it is considered the most appropriate of several methods of classification. Table 4-8 list the drugs with their recognized trade names, some commonly used street names, and observable symptoms of abuse.

The following sections contain specific information about commonly abused drugs, as classified in table 4-8, including availability and methods of administration.

## Narcotic Intoxication

Unfortunately, abuse of narcotic drugs is common. This group of drugs includes the most effective and widely used pain killers in existence. Continual use of narcotic drugs, even under medical supervision, inevitably leads to physical and psychological dependence. The more commonly known drugs within this group are opium, morphine, heroin, codeine, and methadone (a synthetic narcotic). In addition, Darvon and Talwin are included in this group because of their narcotic-like action. Next to cocaine (discussed later), heroin is the most popular narcotic drug because of its intense euphoria and long-lasting effect. It is far more potent than morphine but has no legitimate use in the United States. Heroin appears as a white, gray, or tan, fluffy powder. The most common method of using heroin is by injection directly into the vein, although it can be sniffed. Codeine, although milder than heroin and morphine, is sometimes abused as an ingredient in cough syrup preparations. Symptoms of narcotic drug abuse include slow shallow breathing, possible unconsciousness, constriction (narrowing) of the pupils of the eyes to pinpoint size, drowsiness, confusion, and slurred speech.

The narcotic drug abuser, suddenly withdrawn from drugs, may appear as a wildly disturbed person who is agitated, restless, and possibly hallucinating.

## Alcohol Intoxication

Alcohol is the most widely abused drug today. Alcohol intoxication is so common that it often fails to receive the attention and respect it deserves. Although there are many alcohols, the type consumed by people is known as ethyl

Table 4-8.—Classification of abused drugs

Group/Agent	Trade Name	Some Street Names	Symptoms of Abuse
A. NARCOTICS			
Morphine	.....	H, Miss Emma, Smack	Lethargy, drowsiness, confusion, euphoria, slurred speech, flushing of the skin on face, neck and chest, nausea and vomiting, pupils constricted to pinpoint size.
Diacetylmorphine	Heroin	H, Horse, Harry	
Codeine	.....	Schoolboy	
Meperidine	Demerol		
Methadone	Dolphine	Dollies	
Propoxyphene	Darvon		
Pentazocine	Talwin		
B. ALCOHOL (ethyl)			
	Ethanol	Liquors, beer, wines	Slurred speech, incoordination, confusion, tremors, drowsiness, agitation, nausea and vomiting, respiratory depression, hallucinations, possible coma.
C. BARBITURATES			
	.....	Downers	Same as those noted in alcohol intoxication plus pupils may be dilated.
Phenobarbital	.....	Pheenies	
Amobarbital	Amytal	Blues, blue birds	
Pentobarbital	Nembutal	Yellows, yellow jackets	
Secobarbital	Seconal	Reds, red devils, seggy	
D. OTHER SEDATIVES & HYPNOTICS			
	.....	Downers	Same as those noted in alcohol and barbiturate intoxication.
Glutethimide	Doriden		
Chlordiazepoxide	Librium		
Meproamate	Miltown, Equanil		
E. STIMULANTS			
	.....	Uppers	Excitability, rapid and unclear speech, restlessness, tremors, sweating, dry lips and mouth, dilated pupils, loss of consciousness, coma, hallucinations.
Amphetamine	Dexedrine	Cartwheels, bennies	
Dextroamphetamine	Dexedrine		
Methamphetamine	Methadrine	Speed, meth, crystal crank	
Methylphenidate	Ritalin		

Table 4-8.—Classification of abused drugs—Continued

Group/Agent	Trade Name	Some Street Names	Symptoms of Abuse
F. HALLUCINOGENS			Trance like state, anxiety, confusion, tremors, euphoria, depression, hallucinations, psychotic manifestations, suicidal or homicidal tendencies.
Lysergic acid diethylamide		LSD, acid	
Mescaline			
Psilocin, psilocybin	Peyote	Buttons	
G. CANNABIS			Euphoria, excitability, increased appetite, dryness of mouth, odor of burned rope on breath, intoxication, laughter, mood swings, increase in heart rate, reddening of eyes, loss of memory, distortion of time and spatial perception.
	Marijuana	Pot, grass, weed, joint, tea, reefer, rope, Jane, hay	

alcohol (ethanol). It is the major chemical ingredient in wines, beers, and distilled liquors. Ethanol is a colorless, flammable, intoxicating liquid, classed as a drug because it depresses the central nervous system, affecting physical and mental activities.

Alcohol affects the body of the abuser in stages. Initially, there is a feeling of relaxation and well-being, followed by a gradual disruption of coordination, resulting in inability to accurately and efficiently perform normal activities and skills. Continued alcohol consumption depresses body functions sufficiently to impair breathing and to cause loss of consciousness, coma, and even death.

The physical and psychological addiction potential is very high when alcohol is abused. Withdrawal from alcohol by the abuser can result in delirium tremens (DTs), characterized by anxiety, confusion, restless sleep, sweating, profound depression, hallucinations, and seizures.

Whether in or out of the health care facility, the severely intoxicated individual must be attentively monitored by the health care worker. Obviously, prevention of aspiration, when possible,

is the first order of business. In alcohol intoxication, emergency care is indicated following an episode of aspirating vomitus. If aspiration has occurred, airway management and maintenance of cardiopulmonary functions are critical emergency care measures.

### Barbiturate Intoxication

The legitimate use of barbiturates is primarily to induce sleep and to relieve tension. They are depressants (downers), and statistically they are the most lethal of the abused drugs because of the depth of coma that can result from respiratory depression and circulatory collapse. The commonly known drugs within this group include phenobarbital, amobarbital, pentobarbital, and secobarbital. They may appear in the form of capsules, tablets, and liquids. Overdose potential is extremely high, and can occur accidentally, especially if the barbiturate is taken in conjunction with alcohol, which tends to multiply the effects of depressant drugs. The physical symptoms of barbiturate abuse include slurred speech, faulty judgment, poor memory, staggering, tremors,

rapid movement of the eyeballs with the pupils appearing normal, rapid shallow breathing, and possible shock and coma.

### **Nonbarbiturate Tranquilizer Intoxication**

This group of drugs exhibits the same depressant (downer) action as the barbiturates. The more commonly known drugs within this group include Librium, Valium, Doriden, Miltown, Equanil, and Quaalude. Although there is a possibility of overdose and physical addiction, it is not nearly as great as with the barbiturate drugs and requires larger doses taken over a longer period of time. These drugs are widely used in clinical practice because they are considered to have a wide margin of safety.

### **Stimulant Intoxication**

The stimulants (uppers) directly affect the central nervous system by increasing mental alertness and combating drowsiness and fatigue. One group of stimulants, called amphetamines, is legitimately used in the treatment of conditions such as mild depression, obesity, and narcolepsy (sleeping sickness).

The amphetamines, known as “speed” by the abuser, are the most commonly abused stimulants and include such drugs as Benzedrine, Dexedrine, Dexamyl, Desoxyn, Methedrine, and Syndrox. Stimulants may be abused by taking them orally as capsules or tablets, “snorting” them through the nose, or injecting them into the veins for an immediate and more intense effect.

Physical symptoms of amphetamine abuse include hyperactivity, increased respiration, dilated pupils, increased alertness, sweating, elevated temperature, depressed appetite, and convulsions.

The “comedown” from amphetamine abuse is so unpleasant that the temptation to take repeated doses is overwhelming and sometimes results in the abuser going on “speed runs,” which can last up to a week. Then the abuser may sleep several days before awaking depressed, lethargic, and extremely hungry.

Large quantities of amphetamines are physically addicting, and even small amounts can result in psychological dependence. Tolerance to high doses develops, and withdrawal symptoms occur. During the depression state associated with withdrawal, suicide attempts are not uncommon.

Cocaine, although classified as a narcotic, acts as a stimulant and is commonly abused. It is relatively ineffective when taken orally; therefore

the abuser either injects it into the vein or “snorts” it through the nose. Its effect is much shorter than that of amphetamines, and occasionally the abuser may inject or snort cocaine every few minutes in an attempt to maintain a constant stimulation and prevent depression experienced during withdrawal (comedown). Overdose is very possible, often resulting in convulsion and death.

The physical symptoms observed in the cocaine abuser will be the same as those observed in the amphetamine abuser.

### **Hallucinogen Intoxication**

The group of drugs that affect the central nervous system by altering the user’s perception of self and environment are commonly known as hallucinogens. Included within this group are lysergic acid diethylamide (LSD), mescaline, dimethoxymethylamphetamine (STP), phenicyclidine (PCP), and psilocybin. They appear in several forms: crystals, powders, and liquids.

The symptoms of hallucinogenic drugs include dilated pupils, flushed face, increased heartbeat, and a chilled feeling. In addition, the person may display a distorted sense of time and self, show emotions ranging from ecstasy to horror, and experience changes in visual depth perception.

Although no known deaths have resulted from the drugs directly, hallucinogen-intoxicated persons have been known to jump from windows, walk in front of automobiles, or injure themselves in other ways because of the vivid but unreal perception of their environment.

Even though no longer under the direct influence of a hallucinogenic drug, a person who has formerly used one of the drugs may experience a spontaneous recurrence (flashback) of some aspect of the drug experience. The most common type of flashback is the recurrence of perceptual distortion, but disturbing emotion or panic have also occurred. Flashback may be experienced by heavy or occasional users of the hallucinogenic drugs, and its frequency is unpredictable and its cause unknown.

### **Cannabis Intoxication**

Cannabis sativa, commonly known as marijuana, is widely abused and can best be classified as a mild hallucinogen. The most common physical appearance of marijuana is as ground dried leaves, and the most common method of consumption is by smoking. After a single inhaled

dose of marijuana, measurable physical effects reach a maximum within 1/2 hour and disappear in 3 to 5 hours.

The physical symptoms of Cannabis (marijuana) abuse include dryness of the mouth, irritation of the throat, bloodshot eyes, increased appetite, dizziness or sleepiness, and, in heavy smokers, a cough.

Adverse reactions to the drug include anxiety, fear, drying, depression, suspicion, delusions, and, in rare cases, hallucinations.

Although marijuana can produce psychological dependence, there is no evidence of physical dependence; therefore, there are usually no withdrawal symptoms following its discontinuance.

### Handling Drug-Intoxicated Persons

As in any emergency medical situation, priorities of care must be established. Conditions involving respiratory or cardiac failure must receive immediate attention before specific action is directed to the drug abuse symptom. General priorities of care are outlined below.

- Check for adequacy of airway, breathing, and circulation, and for shock. Give appropriate treatment.
- Keep the victim awake.
- If the victim is sleepy or poorly responding to pain, stimulate by using cold wet towels, gentle shaking, conversation, and moving about.
- If the victim cannot be aroused, place him or her on his or her side so secretions and vomitus will drain from the mouth and not be aspirated into the lungs.
- Induce vomiting if the victim is conscious and the drug was taken orally.
- Prevent the victim from self-injury while highly excited or lacking coordination. Use physical restraints only if absolutely necessary.
- Calm and reassure the excited victim by "talking him or her down" in a quiet, relaxed, and sympathetic manner.
- Gather materials and information to assist in identifying and treating the suspected drug problem. Spoons, paper sacks, eye droppers, hypodermic needles, vials, or

collapsible tubes are excellent identification clues.

- The presence of capsules, pills, drug containers, or needle marks (tracks) on the victim's body are also significant.
- A personal history of drug use from the victim or those accompanying the victim is very important and may reveal how long the victim has been abusing drugs, approximate amounts taken, and time between doses. Also, knowledge of past medical problems, including history of convulsion (with or without drugs) is important.
- Transport the victim and the materials collected to a medical treatment facility.
- Brief medical facility personnel and present the materials collected at the scene upon arrival at the medical treatment facility.

### ENVIRONMENTAL INJURIES

Under the broad category of environmental injuries, we will consider a number of first aid problems. Exposure to extremes of temperature,

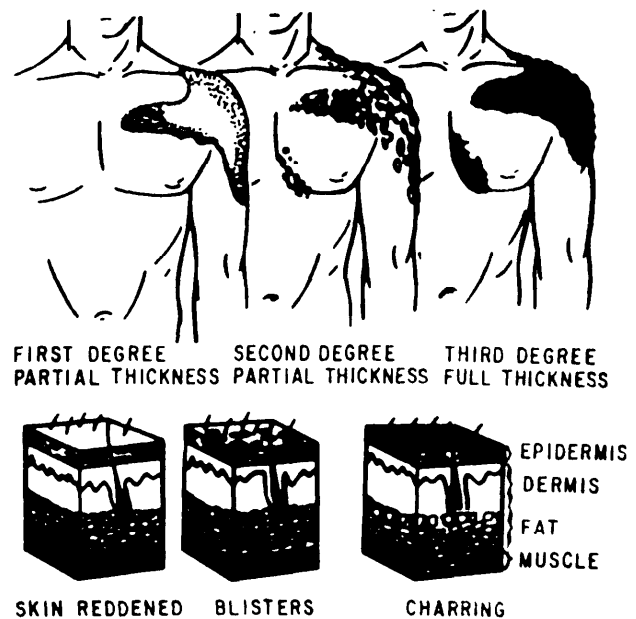


Figure 4-71.—Classification of burns.

136.32

whether heat or cold, causes injury to skin, tissues, blood vessels, vital organs, and, in some cases, the whole body. In addition, contact with the sun's rays, electrical current, or certain chemicals cause injuries similar in character to burns.

## THERMAL BURNS

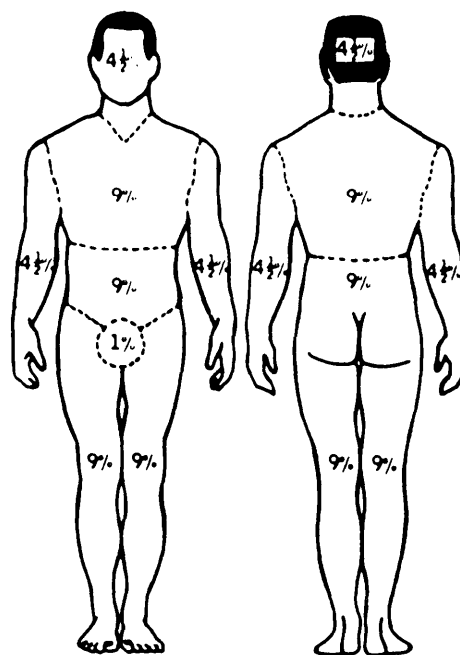
True burns are generated by exposure to extreme heat that overwhelms the body's defensive mechanisms. Burns and scalds are essentially the same injury, burns being caused by dry heat, and scalds by moist heat. The seriousness of the injury can be estimated by the depth, extent, and location of the burn, the age and health of the victim, and other medical complications.

Burns can be classified according to their depth as first-, second-, and third-degree burns, as shown in figure 4-71. With a first-degree burn, the epidermal layer is irritated, reddened, and tingling. The skin is sensitive to touch and blanches with pressure. Pain is mild to severe. Edema is minimal. Healing usually occurs naturally within a week.

A second-degree burn is characterized by epidermal blisters, mottled appearance, and a red base. Damage extends into, but not through, the dermis. Recovery usually takes 2 to 3 weeks, with some scarring and depigmentation. This condition is painful. Body fluids may be drawn into the injured tissue, causing edema and possible a "weeping" fluid (plasma) loss at the surface.

Third-degree burns are full-thickness injuries penetrating into muscle and fatty connective tissues or even down to the bone. Tissues and nerves are destroyed. Shock with blood in the urine is likely to be present. Pain will be absent at the burn site if all the area nerve endings are destroyed and the surrounding tissue, which is less damaged, will be painful. Tissue color will range from white (scalds) to black (charring burns). Although the wound is usually dry, body fluids will collect in the underlying tissue and if the area has not been completely cauterized, significant amounts of fluids will be lost by plasma "weeping" or by hemorrhage, thus reducing circulation volume. There is considerable scarring and possible loss of function. Skin grafts may be necessary.

Of greater importance than the depth of the burn in evaluating the seriousness of the condition is the extent of the burned area. A first-degree burn over 50 percent of the body surface area (BSA) may be more serious than a third-degree burn over 3 percent. The "Rule of Nines" is used to give a rough estimate of the surface area



136.31

Figure 4-72.—Rule of Nines.

affected. Figure 4-72 shows how the rule is applied to adults.

A third factor in burn evaluation is the location of the burn. Serious burns of the head, hands, feet, or genitals will require hospitalization.

The fourth factor is the presence of any other complications, especially respiratory tract injuries or other major injuries or factors.

The corpsman must take all these factors into consideration when evaluating the condition of the burn victim, especially in a triage situation.

## First Aid

After the victim has been removed from the source of the thermal injury, first aid should be kept to a minimum.

- Maintain an open airway.
- Control hemorrhage, and treat for shock.
- Remove constricting jewelry and articles of clothing.
- Protect the burn area from contamination by covering it with clean sheets or dry dressings. DO NOT remove clothing adhering to a wound.

- Splint fractures.
- For all serious and extensive burns (over 20 percent BSA), and in the presence of shock, start intravenous therapy with an electrolyte solution (Ringer's lactate) in an unburned area.
- Maintain intravenous treatment during transportation.
- Relieve mild pain with aspirin. Relieve moderate pain with cool wet compresses or ice water immersion (for burns of less than 20 percent BSA). Severe pain may be relieved with morphine or demerol injections. Pain resulting from small burns may be relieved with an anesthetic ointment if the skin is not broken.

#### Aid Station Care

- Continue to observe for airway patency, hemorrhage, and shock.
- Continue intravenous therapy that is in place, or start a new one under a medical officer's supervision to control shock and replace fluid loss.
- Monitor urine output.
- Shave body hair well back from the burned area and then cleanse the area gently with disinfectant soap and warm water. Remove dirt, grease, and nonviable tissue. Apply a sterile dressing of dry gauze. Place bulky dressings around the burned parts to absorb serous exudate.
- All major burn victims should be given a booster dose of tetanus toxoid to guard against infection. Administration of antibiotics may be directed by a medical officer.
- If evacuation to a definitive care facility will be delayed for 2 to 3 days, start topical antibiotic chemotherapy after the patient stabilizes and following debridement and wound care. Gently spread a 1/16-inch thickness of Sulfamylon or Silvadene over the burn area. Repeat the application after

12 hours, and then after daily debridement. Treat minor skin reactions with antihistamines.

#### SUNBURN

Sunburn results from prolonged exposure to the ultraviolet rays of the sun. First- and second-degree burns similar to thermal burns result. Treatment is essentially the same as that outlined for thermal burns. Unless a major percentage of the body surface is affected, the victim will not require more than first aid attention. Commercially prepared sunburn lotions and ointments may be used. Prevention through education and the proper use of sun screens is the best way to avoid this condition.

#### ELECTRICAL BURNS

Electrical burns may be far more serious than a preliminary examination may indicate. The entrance and exit wounds may be small, but as electricity penetrates the skin it burns a large area below the surface, as indicated in figure 4-73. A corpsman can do little for these victims other than monitoring the basic life functions, delivering CPR, treating for shock if necessary, covering the entrance and exit wounds with a dry, sterile

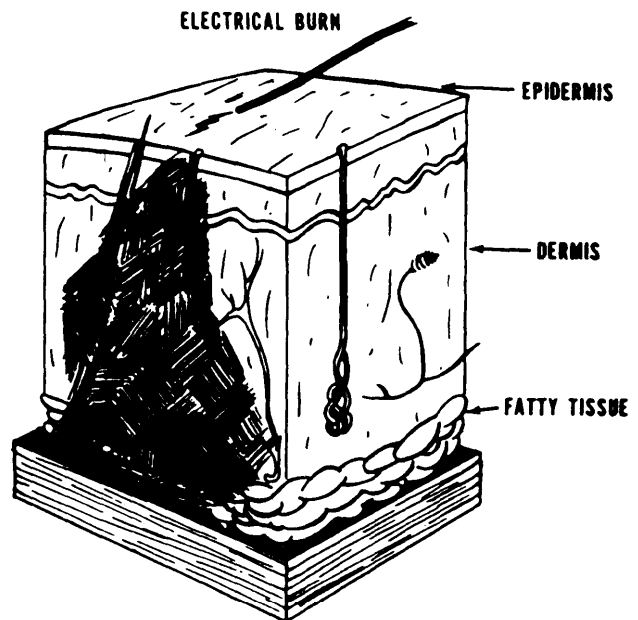
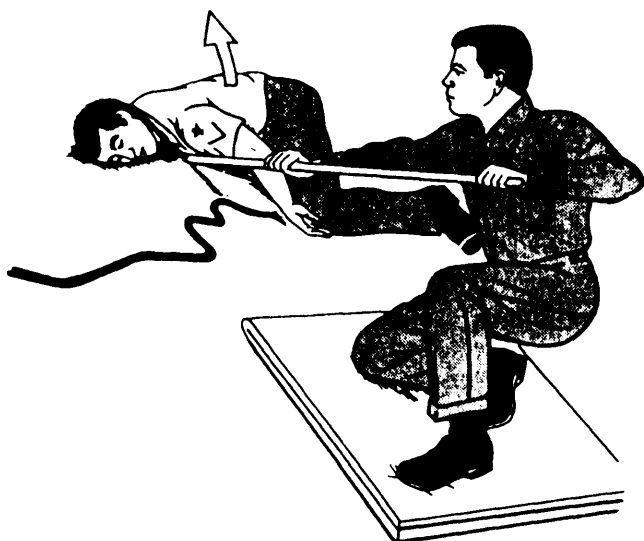


Figure 4-73.—Electrical burns.

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Figure 4-74.—Moving a victim away from an electrical line.

dressing, and transporting the victim to a medical treatment facility.

Before treatment is started, ensure that the victim is no longer in contact with a live electrical source. Shut the power off or use a nonconducting rope or stick to move the victim away from the line or the line away from the victim (fig. 4-74).

## CHEMICAL BURNS

When acids, alkalies, or other chemicals come in contact with the skin or other body membranes, they may cause injuries that are generally referred to as chemical burns. For the most part, these injuries are not caused by heat but by direct chemical destruction of body tissues. Areas most often affected are the extremities, mouth, and eyes. Alkali burns are usually more serious than acid burns, because alkalies penetrate deeper and burn longer.

When such burns occur, the following emergency procedures must be carried out immediately:

1. Quickly flush the area with large amounts of water, using a shower or hose, if available. Do not apply water too forcefully. Continue to flood the area while the clothing, including shoes and socks, is being removed, as well as afterwards. **NOTE:** There are two exceptions to the above. In

alkali burns caused by dry lime, the mixing of water and lime creates a very corrosive substance. Dry lime should be brushed away from the skin and clothing, unless large amounts of water are available for rapid and complete flushing. In acid burns caused by phenol (carbolic acid), wash the affected area with alcohol because phenol is not water soluble; then wash with water. If alcohol is not available, flushing with water is better than no treatment at all.

2. After thorough washing, neutralize any chemical remaining on the affected area. **WARNING: DO NOT** attempt to neutralize a chemical unless you know exactly what it is and what substance will neutralize it. Further damage may be done by a neutralizing agent that is too strong or incorrect. For acid burns make a solution of 1 teaspoon of baking soda in a pint of water and flush it over the affected area. For alkali burns mix 1 or 2 teaspoons of vinegar in a pint of water and flush it over the affected area.
3. Flush the area again with water and gently pat dry with a sterile gauze. Do not rub the area.
4. Transport the victim to a medical treatment facility.

## Chemical Burns to the Eye

The one and only emergency treatment is to flush the eye(s) immediately with large amounts of water or a sterile saline solution. Acid burns to the eyes should be irrigated for at least 5 to 10 minutes with at least 2000 ml of water. Alkali burns should be irrigated for at least 20 minutes. Because of the intense pain, the victim may be unable to open the eyes. If this occurs, hold the eyelids apart so that water can flow across the eye.

A drinking fountain or field "water buffalo" may be used to supply a steady stream of water. Hold the victim's head in a position that allows water to flow from the inside corner of the eye toward the outside. Do not allow the water to fall directly on the eye, not use greater force than is necessary to keep the water flowing across the eye.

**CAUTION:** Never use any chemical antidotes such as baking soda or alcohol in treating burns of the eye and do not try to neutralize chemical agents.

After thorough irrigation loosely cover both eyes with a clean dressing. This prevents further damage by decreasing eye movement.

The aftercare for all chemical burns is similar to that for thermal burns: cover the affected area and get the victim to a medical treatment facility as soon as possible.

## **WHITE PHOSPHORUS BURNS**

A special category of burns that may affect military personnel in a wartime or training situation is that caused by exposure of white phosphorus (WP or Willy Peter). First aid for this type of burn is complicated by the fact that white phosphorus particles ignite upon contact with air.

Superficial burns caused by simple skin contact or burning clothes should be flushed with water and treated like thermal burns. Partially embedded white phosphorus particles must be continuously flushed with water while the first aid provider removes them with whatever tools are available (i.e., tweezers, pliers, forceps). Do this quickly but gently. Firmly or deeply embedded particles that cannot be removed by the first aid provider must be covered with a saline soaked dressing, which must be kept wet until the victim reaches a medical treatment facility. The wounds containing embedded phosphorus particles may then be rinsed with a dilute, one percent freshly mixed solution of copper sulfate. This solution combines with phosphorus on the surface of the particles to form a blue-black cupric phosphite covering, which both impedes further oxidation and facilitates identification of retained particles. Under no circumstances should the copper sulfate solution be applied as a wet dressing. Wounds must be flushed thoroughly with a saline solution following the copper sulfate rinse to prevent absorption of excessive amounts of copper, since copper has been associated with extensive intravascular hemolysis. An adjunct to the management of phosphorus burn injuries is the identification of the retained phosphorescent particles in a darkened room during debridement.

**NOTE:** Combustion of white phosphorus results in the formation of a severe pulmonary irritant. The ignition of phosphorus in a closed space such as the BAS tent or sickbay may result in the development of irritant concentrations sufficient to cause acute inflammatory changes in the tracheobronchial tree. The effects of this gas, especially during debridement, can be minimized

by placing a moist cloth over the nose and mouth to inactivate the gas and by ventilating the tent.

## **HEAT EXPOSURE INJURY**

Excessive heat affects the body in a variety of ways. When a person exercises or works in a hot environment, heat builds up inside the body. The body automatically reacts to get rid of this heat through the sweating mechanism. This depletes water and electrolytes from the circulating volume. If they are not adequately replaced, body functions are affected, and initially, heat cramps and heat exhaustion develop. If the body becomes too overheated, or water or electrolytes too depleted, the sweat control mechanism of the body malfunctions and shuts down. The result is heat stroke (sunstroke). Heat exposure injuries are a threat in any hot environment, but especially in desert or tropical areas and in the boiler rooms of ships. Under normal conditions it is a preventable injury. Individual and command awareness of the causes of heat stress problems should help eliminate heat exposure injuries.

### **Heat Cramps**

Excessive sweating may result in painful cramps in the muscles of the abdomen, legs, and arms. Heat cramps may also result from drinking ice water or other cold drinks either too quickly or in too large a quantity after exercise. Muscle cramps are often an early sign of approaching heat exhaustion.

To provide first aid treatment for heat cramps, move the victim to a cool place. Since heat cramps are caused by loss of salt and water, give the victim plenty of cool (not cold) water to drink, adding about one teaspoon of salt to a liter or quart of water. Apply manual pressure to the cramped muscle, or gently massage it to relieve the spasm. If there are indications of anything more serious, transport the victim immediately to a medical treatment facility.

### **Heat Exhaustion**

Heat exhaustion (heat prostration or heat collapse) is the most common condition caused by working or exercising in hot environments. In heat exhaustion there is a serious disturbance of blood flow to the brain, heart, and lungs. This causes the victim to experience weakness, dizziness, headache, loss of appetite, and nausea. The victim may faint, but he or she will probably regain

consciousness as the head is lowered, which improves the blood supply to the brain. Signs and symptoms of heat exhaustion are similar to those of shock; the victim will appear ashen gray, the skin cool, moist, and clammy and the pupils may be dilated (fig. 4-75). The vital signs usually are normal; however, the victim may have a weak pulse, together with rapid and shallow breathing. Body temperature may be below normal.

Treat heat exhaustion as if the victim were in shock. Move the victim to a cool or air-conditioned area. Loosen the clothing, apply cool wet cloths to the head, axilla, groin, and ankles, and fan the victim. Do not allow the victim to become chilled (if this does occur, then cover with a light blanket and move into a warmer area). If the victim is conscious, give a solution of 1 teaspoon of salt dissolved in a liter of cool water. If the victim vomits, do not give any more fluids. Transport the victim to a medical treatment facility as soon as possible. Intravenous fluid infusion may be necessary for effective fluid and electrolyte replacement to combat shock.

### Heat Stroke

Sunstroke is more accurately called heat stroke since it is not necessary to be exposed to the sun for this condition to develop. It is a less common but far more serious condition than heat exhaustion, since it carries a 20 percent mortality rate. The most important feature of heat stroke is the extremely high body temperature (105°F, 41°C, or higher) accompanying it. In heat stroke the victim suffers a breakdown of the sweating mechanism and is unable to eliminate excessive

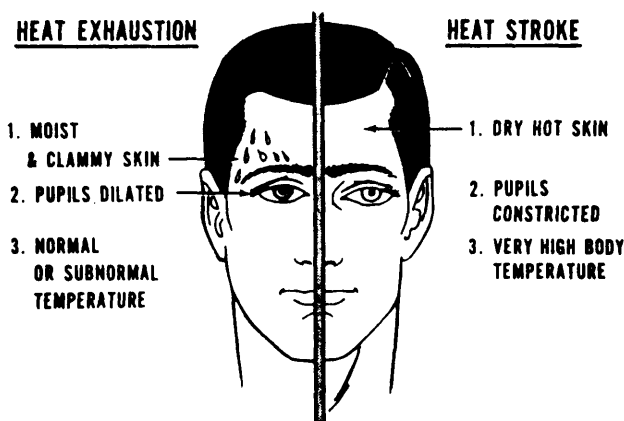
body heat build up while exercising. If the body temperature rises too high, the brain, kidneys, and liver may be permanently damaged.

Sometimes the victim may have preliminary symptoms such as headache, nausea, dizziness, or weakness. Breathing will be deep and rapid at first, later shallow and almost absent. Usually the victim will be flushed, very dry, and very hot. The pupils will be constricted (pinpoint) and the pulse fast and strong (fig. 4-75). Compare these symptoms with those of heat exhaustion.

When providing first aid for heat stroke, remember that this is a true life-and-death emergency. The longer the victim remains overheated, the more likely irreversible brain damage or death will occur. First aid is designed to reduce body heat fast.

Reduce heat immediately by dousing the body with cold water or by applying wet, cold towels to the whole body. Move the victim to the coolest possible place and remove as much clothing as possible. Maintain an open airway. Place the victim on his or her back, with the head and shoulders slightly raised. If cold packs are available, place them under the arms, around the neck, at the ankles, and in the groin. Expose the victim to a fan or air conditioner, since drafts will promote cooling. Immersing the victim in a cold water bath is also very effective. If the victim is conscious, give cool water to drink. Do not give any hot drinks or stimulants. Discontinue cooling when the rectal temperature reaches 102°F; watch for recurrence of temperature rise by checking every 10 minutes. Repeat cooling if temperature reaches 103 rectally.

Get the victim to a medical facility as soon as possible. Cooling measures must be continued while the victim is being transported. Intravenous fluid infusion may be necessary for effective fluid and electrolyte replacement to combat shock.



136.67

Figure 4-75.—Heat exhaustion and heat stroke.

### Prevention of Heat Exposure Injuries

The prevention of heat exposure injuries is a command responsibility, but the medical department plays a role in it by educating all hands about the medical dangers, monitoring environmental health, and advising the commanding officer.

On the individual level, prevention centers on water and salt replacement. Sweat must be replaced ounce for ounce; in a hot environment, water consumption must be drastically increased. Salt should be replaced by eating well-balanced meals, three times a day, salted to taste. In the field, "C" rations contain enough salt to sustain

a person in most situations. **DO NOT** use salt tablets unless specified by a physician, **DO NOT** consume alcoholic beverages.

At the command level, prevention centers on an awareness of the environment. The Wet Bulb Globe Temperature (WGBT) must be monitored regularly, and the results interfaced with the Physiological Heat Exposure Limits (PHEL) chart and the work/rest chart before work assignments are made. In addition, unnecessary heat sources, especially steam leaks, must be eliminated, and vents and exhaust blowers must be checked for adequate circulation. The results will be a happier, healthier, and more productive crew.

## **COLD EXPOSURE INJURY**

When the body is subjected to extremely cold temperatures, blood vessels constrict, and body heat is gradually lost. As the body temperature drops, tissues are easily damaged or destroyed.

The cold injuries resulting from inadequate response to the cold in military situations have spelled disaster for many armies; for example, those of Napoleon and Hitler in their Russian campaigns. The weather (i.e., temperature, humidity, precipitation, and wind) is the predominant influence in the development of cold injuries. Falling temperature interacting with high humidity, a wet environment, and rising wind accelerates the loss of body heat. The other major causative factor is the type of mission. For example, riflemen involved in static defense or pinned down by enemy fire suffer from greater exposure to the elements and lack the opportunity to properly warm their bodies, change clothes, keep clean, or eat balanced meals. They may also suffer from fatigue and fear, which contribute to apathy and neglect. Other factors that influence the development of cold injuries are dehydration, the presence of other injuries (especially those causing a reduction in circulatory flow), and a previous cold injury (which increases susceptibility by lowering resistance). In addition, the use of any drug, including alcohol, that modifies autonomic nervous system response or alters judgment ability can drastically reduce an individual's chance for survival.

Like heat exposure injuries, cold exposure injuries are preventable. Acclimatization, the availability of warm, layered clothing, and maintenance of good discipline and training standards are important factors. These are command, not medical, responsibilities, but the corpsman will have a crucial role as a monitor of

nutritional intake and personal hygiene (with emphasis on foot care) and as an advisor to the commanding officer. A corpsman will also be responsible for acquainting the troops with the dangers of cold exposure and with prevention measures.

Two major points must be stressed in the management of all cold injuries: Rapid rewarming is of primary importance, and all unnecessary manipulations of affected areas must be avoided. More will be said about these points later. In military operations the treatment of cold injuries is influenced by (1) the tactical situation, (2) the facilities available for the evacuation of casualties, and (3) the fact that most cold injuries are encountered in large numbers during periods of intense combat when many other wounded casualties appear. Highly individualized treatment under these circumstances may be impossible because examination and treatment of more life-endangering wounds must be given priority. In a high casualty situation, shelter cold injury victims, and try to protect them from further injury until there is sufficient time to treat them.

All cold injuries are similar, varying only in the degree of tissue damage. In general, the effects of cold are broken down into two types: general cooling of the entire body and local cooling of parts of the body, but cold injuries will seldom be totally of one type.

### **General Cooling (Hypothermia)**

General cooling of the whole body is caused by continued exposure to low or rapidly falling temperatures, cold moisture, snow, or ice. Those exposed to low temperatures for extended periods may suffer ill effects, even if they are well protected by clothing, because cold affects the body systems slowly, almost without notice. As the body cools, there are several stages of progressive discomfort and disability. The first symptom is shivering, which is an attempt to generate heat by repeated contractions of surface muscles. This is followed by a feeling of listlessness, indifference, and drowsiness. Unconsciousness can follow quickly. Shock becomes evident as the victim's eyes assume a glassy stare, respiration becomes slow and shallow, and the pulse is weak or absent. As the body temperature drops even lower, peripheral circulation decreases and the extremities become susceptible to freezing. Finally, death results as the core temperature of the body approaches 80°F.

Treatment for hypothermia is enumerated as follows:

1. Carefully observe respiratory effort and heart beat; CPR may be required while the warming process is underway.
2. Rewarm the victim as soon as possible. It may be necessary to treat other injuries before the victim can be moved to a warmer place. Severe bleeding must be controlled and fractures splinted over clothing before the victim is moved.
3. Replace wet or frozen clothing and remove anything that constricts the victim's arms, legs, or fingers, interfering with circulation.
4. If the victim is inside a warm place and is conscious, the most effective method of warming is immersion in a tub of warm (100° to 105°F or 38° to 41°C) water. The water should be warm to the elbow—never hot. Observe closely for signs of respiratory failure and cardiac arrest (rewarming shock). Rewarming shock can be minimized by warming the body trunk before the limbs to prevent vasodilation in the extremities with subsequent shock due to blood volume shifts.
5. If a tub is not available, apply external heat to both sides of the victim. Natural body heat (skin to skin) from two rescuers is the best method. This is called "buddy warming." If this is not practical, use hot water bottles or an electric rewarming blanket, but do not place them next to bare skin, and be careful to monitor the temperature of the artificial heat source, since the victim is very susceptible to burn injury. Because the victim is unable to generate adequate body heat, placement under a blanket or in a sleeping bag is not sufficient treatment.
6. If the victim is conscious, give warm liquids to drink. Never give alcoholic beverages or allow the victim to smoke.
7. Dry the victim thoroughly if water is used for rewarming.
8. As soon as possible, transfer the victim to a definitive care facility. Be alert for the signs of respiratory and cardiac arrest during transfer, and keep the victim warm.

### Local Cooling

Local cooling injuries, affecting parts of the body, fall into two categories: freezing and

nonfreezing injuries. In the order of increasing seriousness, they include chilblain, immersion foot, superficial frostbite, and deep frostbite. The areas most commonly affected are the face and extremities.

**CHILBLAIN.**— Chilblain is a mild cold injury caused by prolonged and repeated exposure for several hours to air temperatures from above freezing (32°F/0°C) to as high as 60°F (16°C). Chilblain is characterized by redness, swelling, tingling, and pain to the affected skin area. Injuries of this nature require no specific treatment except warming of the affected part (if possible use a water bath of 90° to 105°F), keeping it dry, and preventing further exposure.

**IMMERSION FOOT.**— Immersion foot, which also may occur in the hands, results from prolonged exposure to wet cold at temperatures ranging from just above freezing to 50°F (10°C) and usually in connection with limited motion of the extremities and water-soaked protective clothing.

Signs and symptoms of immersion foot are tingling and numbness of the affected areas; swelling of the legs, feet, or hands; bluish discoloration of the skin; and painful blisters. Gangrene may occur. General treatment for immersion foot is as follows:

1. Get the victim off his or her feet as soon as possible.
2. Remove wet shoes, socks, and gloves to improve circulation.
3. Expose the affected area to warm dry air.
4. Keep the victim warm.
5. Do not rupture blisters or apply salves and ointments.
6. If the skin is not broken or loose, the injured part may be left exposed; however, if it is necessary to transport the victim, cover the injured area with loosely wrapped fluff bandages of sterile gauze.
7. If the skin is broken, place a sterile sheet under the extremity and gently wrap it to protect the sensitive tissue from pressure and additional injury.
8. Transport the victim as soon as possible to a medical treatment facility as a litter patient.

**FROSTBITE.**— Frostbite occurs when ice crystals form in the skin or deeper tissues after exposure to a temperature of 32°F (0°C) or lower.

Depending upon the temperature, altitude, and wind speed, the exposure time necessary to produce frostbite varies from a few minutes to several hours. The areas commonly affected are the face and extremities.

The symptoms of frostbite are progressive. Victims generally incur this injury without being acutely aware of it. Initially, the affected skin reddens and there is an uncomfortable coldness. With continued heat loss, there is a numbness of the affected area due to reduced circulation. As ice crystals form, the frozen extremity appears white, yellow-white, or mottled blue-white, and is cold, hard, and insensitive to touch or pressure. Frostbite is classified as superficial or deep, depending on the extent of tissue involvement.

**Superficial Frostbite.**— In superficial frostbite the surface of the skin will feel hard, but the underlying tissue will be soft, allowing it to move over bony ridges. This is evidence that only the skin and the region just below it are involved. General treatment for superficial frostbite is as follows:

1. Take the victim indoors.
2. Rewarm hands by placing them under the armpits, against the abdomen, or between the legs.
3. Rewarm feet by placing them in the armpit or against the abdomen of the buddy.
4. Gradually rewarm the affected area by warm water immersion, skin to skin contact, or hot water bottles.
5. Never rub a frostbite area.

**Deep Frostbite.**— In deep frostbite the freezing reaches into the deep tissue layers. There are ice crystals in the entire thickness of the extremity. The skin will not move over bony ridges and feels hard and solid.

The objectives of treatment are to protect the frozen areas from further injury, to rapidly thaw the affected area, and to be prepared to respond to circulatory or respiratory difficulties.

1. Carefully assess and treat any other injuries first. Constantly monitor the victim's pulse and breathing since respiratory and heart problems can develop rapidly. Be prepared to administer CPR if necessary.
2. Do not attempt to thaw the frostbitten area if there is a possibility of refreezing. It is better to leave the part frozen until the victim arrives at a medical treatment facility

equipped for long term care. Refreezing of a thawed extremity causes severe and disabling damage.

3. Treat all victims with injuries to the feet or legs as litter patients. When this is not possible, the victim may walk on the frozen limb, since it has been proven that walking will not lessen the chances of successful treatment as long as the limb has not thawed out.
4. When adequate protection from further cold exposure is available, prepare the victim for rewarming by removing all constricting clothing such as gloves, boots, and socks. Boots and clothing frozen on the body should be thawed by warm water immersion before removal.
5. Rapidly rewarm frozen areas by immersion in water at 100° to 105°F (38° to 41°C). Keep the water warm by adding fresh hot water, but do not pour it directly on the injured area. Ensure that the frozen area is completely surrounded by water; do not let it rest on the side or bottom of the tub.
6. After rewarming has been completed, pat the area dry with a soft towel. Later it will swell, sting, and burn. Blisters may develop. These should be protected from breaking. Avoid pressure, rubbing, or constriction of the injured area. Keep the skin dry with sterile dressings and place cotton between the toes and fingers to prevent their sticking together.
7. Protect the tissue from additional injury and keep it as clean as possible (use sterile dressings and linen).
8. Try to improve the general morale and comfort of the victim by giving hot, stimulating fluids such as tea or coffee. Do not allow the victim to smoke or use alcoholic beverages while being treated.
9. Transfer to a medical treatment facility as soon as possible. During transportation, slightly elevate the frostbitten area and keep the victim and the injured area warm. Do not allow the injured area to be exposed to the cold.

### Later Management of Cold Injury

When the patient reaches a hospital or a facility for definitive care, the following treatment should be employed:

1. Maintain continued vigilance to avoid further damage to the injured tissue. In

general, this is accomplished by keeping the patient at bed rest with the injured part elevated, on surgically clean sheets, and with sterile pieces of cotton separating the toes or fingers. Expose all lesions to the air at normal room temperature. Weight bearing on injured tissue must be avoided.

2. Whirlpool baths, twice daily at 98.6°F (37°C) with surgical soap added, assist in superficial debridement, reduce superficial bacterial contamination, and make range of motion exercises more tolerable.
3. Analgesics may be required in the early post-thaw days but will soon become unnecessary in uncomplicated cases.
4. Encourage the patient to take a nutritious diet with adequate fluid intake to maintain hydration.
5. Perform superficial debridement of ruptured blebs, and remove suppurative scabs and partially detached nails.

## COMMON MEDICAL EMERGENCIES

This section of the chapter deals with some other relatively common medical problems a corpsman may face in a first aid situation. Generally speaking, these particular problems are the result of previously diagnosed medical conditions, so at least for the victim they do not come as a complete surprise. Many of these victims will be wearing a MEDIC ALERT necklace or bracelet, or carrying a MEDIC ALERT identification card that specifies the nature of the medical condition or the type of medications being taken. In all cases of sudden illness, search the victim for a MEDIC ALERT symbol. It may help you diagnose the victim's problem and start appropriate first aid procedures immediately.

After checking the vital signs, you must carefully assess all the signs and symptoms before making a preliminary diagnosis.

- Determine the victim's level of consciousness, including orientation to surroundings and reaction to pain stimulus.
- Check the limbs for weakness or paralysis.
- Check pupil size and reaction to light for signs of brain injury.
- Continuously monitor respiration depth and rate.

- Log all observations carefully for evaluation by a physician.

## FAINTING (SYNCOPE)

Uncomplicated fainting is the result of blood pooling in dilated veins, which reduces the amount of blood being pumped to the brain. Causes include getting up too quickly, standing for long periods with little movement, and stressful situations. Signs and symptoms that may be present are dizziness, nausea, visual disturbance from pupillary dilation, sweating, pallor, and a weak, rapid pulse. As the body collapses, blood returns to the head and consciousness is quickly regained. Revival can be promoted by carefully placing the victim in the shock position or in a sitting position with the head between the knees. Placing a cool wet cloth on the face and loosening the clothing can also help.

Syncope may also result from an underlying medical problem such as diabetes, cerebrovascular accident (stroke), heart condition, or epilepsy.

## DIABETIC CONDITIONS

Diabetes mellitus is an inherited condition in which the pancreas secretes an insufficient amount of the protein hormone insulin. Insulin regulates carbohydrate metabolism by enabling glucose to enter cells for use as an energy source. Diabetics almost always wear a MEDIC ALERT identification symbol.

### Diabetic Ketoacidosis

Diabetics may suffer from rising levels of glucose in the blood stream (hyperglycemia). The rising levels of glucose result in osmotic diuresis, and increase renal excretion of urine. A serious dehydration (hypovolemia) may result. Concurrently, lack of glucose in the cells leads to an increase in metabolic acids in the blood (acidosis) as other substances, such as fats, are metabolized as energy sources. The result is gradual central nervous system depression, starting with symptoms of confusion and disorientation and leading to stupor and coma. Blood pressure falls and the pulse rate becomes rapid and weak. Respirations are deep, and a sickly sweet acetone odor is present on the breath. The skin is warm and dry. (NOTE: Too often a diabetic victim is treated as if intoxicated; the signs and symptoms presented are similar to those of alcohol intoxication.)

The diabetic under treatment tries to balance the use of insulin against glucose intake to avoid the above problems. Diabetic ketoacidosis most often results either from forgetting to take insulin or from taking too little insulin to maintain a balanced condition. The victim or the victim's family may be able to answer two key questions:

- Has the victim eaten today?
- Has he or she taken the prescribed insulin?

If the answer is yes to the first and no to the second question, the victim is probably in a diabetic coma.

Emergency first aid centers around ABC support, administration of oral or intravenous fluids to counter shock, and rapid evacuation to a medical officer's supervision.

### **Insulin Shock**

Insulin shock results from too little sugar in the blood (hypoglycemia). It develops when a diabetic exercises too much or eats too little after taking insulin. This is a very serious condition, because glucose is driven into the cells to be metabolized, leaving too little in circulation to support the brain. Brain damage develops quickly. Signs and symptoms include:

- Pale, moist skin.
- Dizziness and headache.
- Strong, rapid pulse.
- Fainting, seizures, and coma.
- Normal respiration and blood pressure.

Treatment is centered on getting glucose into the system quickly to prevent brain damage. Placing sugar cubes under the tongue is most beneficial. Transport the victim to a medical treatment facility as soon as possible.

**NOTE:** If you are in doubt as to whether the victim is in insulin shock or a ketoacidotic state, give sugar. Brain damage develops very quickly in insulin shock and must be reversed immediately. If the victim turns out to be ketoacidotic, the extra sugar will do no appreciable harm since this condition progresses slowly.

### **CEREBROVASCULAR ACCIDENT**

A cerebrovascular accident, also known as a stroke or apoplexy, is caused by an interruption of the arterial blood supply to a portion of the brain. This interruption may be caused by arteriosclerosis or by a clot forming in the brain. Tissue damage and loss of function result.

Onset is sudden, with little or no warning. The first signs include weakness or paralysis on the side of the body opposite the side of the brain that has been injured. Muscles of the face on the affected side may be involved. The level of consciousness varies from alert to nonresponsive. Motor functions on the affected side are disturbed, including vision and speech, and the throat may be paralyzed.

First aid is mainly supportive. Special attention must be paid to the airway, since the victim may not be able to keep it clear. Place the victim in a semireclining position or on the paralyzed side.

- Be prepared to use suction if the victim vomits.
- Act in a calm, reassuring manner, and keep onlookers quiet since the victim may be able to hear what is going on.
- Administer oxygen to combat cerebral hypoxia.
- Carefully monitor vital signs and keep a log. Pay special attention to respirations, pulse strength and rate, and the presence or absence of the bilateral carotid pulse.
- Transport the victim to a medical treatment facility as soon as possible.

### **ANAPHYLACTIC REACTIONS**

This condition, also called anaphylaxis or anaphylactic shock, is a severe allergic reaction to foreign material. Penicillin and the toxin from bee stings are probably the most common causative agents, although foods, inhalants, and contact substances can also cause a reaction. Anaphylaxis can happen at any time, even to people who have taken penicillin many times before without experiencing any problems. This condition produces severe shock and cardiopulmonary failure of a very rapid onset. Because of this, immediate intervention is necessary. The general

treatment for severe anaphylaxis is the subcutaneous injection of 0.3cc of epinephrine and supportive care.

The most characteristic and serious symptoms of an anaphylactic reaction are loss of voice and difficulty breathing. Other typical signs are giant hives, coughing, and wheezing. As the condition progresses, signs and symptoms of shock develop, followed by respiratory failure. Emergency management consists of maintaining vital life functions. The medical officer must be summoned immediately.

## **HEART CONDITIONS**

A number of heart conditions are commonly referred to as heart attacks. These include angina pectoris, acute myocardial infarction, and congestive heart failure. Together they are the cause of at least half a million deaths per year in our country. They occur more commonly in men in the 50 to 60 year age group. Predisposing factors are lack of physical conditioning, high blood pressure and blood cholesterol levels, smoking, diabetes, and a family history of heart disease.

### **Angina Pectoris**

This condition is caused by insufficient oxygen being circulated to the heart muscle. It results from a partial occlusion of the coronary artery, which allows the heart to function adequately at rest, but it does not allow enough oxygen enriched blood through to support sustained exercise. When the body exerts itself, the heart muscle becomes starved for oxygen, resulting in a squeezing substernal pain that may radiate to the left arm and to the jaw.

Angina is differentiated from other forms of heart problems since the pain results from exertion and subsides with rest. Many people who suffer from angina pectoris carry nitroglycerin tablets. If the victim of a suspected angina attack is carrying a bottle of these pills, place one pill under the tongue. Relief will be almost instantaneous. Other first aid procedures include reassurance, comfort, monitoring vital signs, and transporting the victim to a medical treatment facility.

### **Acute Myocardial Infarction**

This condition results when a coronary artery is severely occluded by arteriosclerosis or completely blocked by a clot. The pain is similar to

that of angina pectoris, but is longer in duration, not related to exertion or relieved by nitroglycerin, and leads to death of heart muscle tissue. Other symptoms are sweating, weakness, and nausea. The pulse rate increases and may be irregular; blood pressure falls; respirations are usually normal. The victim may have an overwhelming feeling of doom. Quick or lingering death may result.

First aid for an acute myocardial infarction includes:

- Reassurance and comfort while placing the victim in a semi-sitting position.
- Loosening of all clothing.
- Carefully maintaining a log of vital signs, and recording the history and general observations.
- Continuously monitoring vital signs and being prepared to start CPR.
- Starting a slow intravenous infusion of 5 percent dextrose solution in water.
- Administering oxygen.
- Quickly transporting the victim to a medical treatment facility.

### **Congestive Heart Failure**

A heart suffering from prolonged hypertension, valve disease, or heart disease will try to compensate for decreased function by increasing the size of the left ventricular pumping chamber and increasing the heart rate. As blood pressure increases, fluid is forced out of the blood vessels and into the lungs, causing pulmonary edema. This leads to rapid shallow respirations, the appearance of pink frothy bubbles at the nose and mouth and a distinctive “rales” sound in the chest. Increased blood pressure may also cause body fluids to pool in the extremities.

Emergency treatment for congestive heart failure is essentially the same as that for acute myocardial infarction. Do not start CPR unless heart function ceases. A sitting position promotes blood pooling in the lower extremities. If an intravenous line is started, it should be maintained at the slowest rate possible to keep the vein open; an increase in the circulatory volume will worsen the condition. Immediate transport to a medical treatment facility is indicated.

## CONVULSIONS

Convulsions, or seizures, are a startling and often frightening phenomenon. They are characterized by severe muscle spasms or muscle rigidity of an uncontrolled nature. Convulsive episodes occur in 1 to 2 percent of the general population.

Although epilepsy is the most widely known form of seizure activity, there are numerous causes that are classified as either central nervous system (CNS) or non-CNS in origin. It is especially important to determine the cause in patients who have no previous history of seizure activity. This may require an extensive medical workup in the hospital. Since epilepsy is the most widely known, this section will highlight epileptic seizure disorders.

Epilepsy, also known as seizures or fits, is a condition characterized by an abnormal focus of activity in the brain that produces severe motor responses or changes in consciousness. It may result from head trauma, scarred brain tissue, brain tumors, cerebral arterial occlusion, fever, or a number of other factors. Fortunately, it can often be controlled by medications.

Grand mal seizure is the more serious type of epilepsy. It may be, but is not always preceded by an aura that its victim soon comes to recognize, allowing time to lie down and prepare for the onset of the seizure. A burst of nerve impulses from the brain causes unconsciousness and generalized muscular contractions, often with loss of bladder and bowel control. The primary dangers are tongue biting and injuries resulting from falls. A period of sleep or mental confusion follows. When full consciousness returns, the victim will have little or no recollection of the attack.

Petit mal seizure is of short duration and is characterized by an altered state of awareness or partial loss of consciousness and localized muscular contractions. There is no warning and little or no memory of the attack after it is over.

Although first aid treatment consists of protecting the victim from self injury and placing a padded bite stick between the jaws to prevent tongue biting, additional methods of control may be employed under a medical officer's supervision. In all cases, be prepared to provide suction since the risk of aspiration is significant.

### Medications

Unless hypoglycemia can be ruled out, an intravenous infusion of 50cc of a 50 percent dextrose solution in water may be used. For immediate control of severe convulsions,

Diazepam (Valium) may be used, administered 5 to 10 mg intravenously at 5 mg/min. Watch for respiratory depression and hypotension. Diphenylhydantoin (Dilantin) can also be used, but it takes approximately 20 minutes to achieve therapeutic levels. Administration is 50 mg/min up to the 1000 mg maximum dose. Phenobarbital is an alternate to Diphenylhydantoin but is not preferred due to its hypnotic effects. Dosage is 150 to 250 mg intravenously at 25 mg/min. This may be repeated in 15 minutes up to a maximum dosage of 400 mg in the first 2 hours.

## DROWNING

Drowning is a suffocating condition in a water environment. Water seldom enters the lungs in appreciable quantities because, upon contact with fluid, laryngeal spasms occur which seals the airway from the mouth and nose passages. To avoid serious damage from the resulting hypoxia, quickly bring the victim to the surface and start artificial ventilation, even before the victim is pulled to shore. Do not interrupt artificial ventilation until the rescuer and victim are on dry ground, then quickly administer an abdominal thrust to empty the lungs and immediately restart the ventilation until spontaneous breathing returns. Oxygen enrichment is desirable if a mask is available.

Remember that an apparently lifeless person who has been immersed in cold water for a long period may be revived if artificial ventilation is started immediately.

## PSYCHIATRIC EMERGENCIES

A psychiatric emergency is defined as a sudden onset of behavioral or emotional responses that, if not responded to, will result in a life-threatening situation. Probably the most common psychiatric emergency is the suicide attempt. This may range from verbal threats and suicide gestures to successful suicide. Always assume that a suicide threat is real; do not leave the patient alone. In all cases, the prime consideration is to keep patients from inflicting harm to themselves and getting them under the care of a trained psychiatric professional. In the case of gestures or attempts, treat self-inflicted wounds as any other wound. In the case of ingested substances, do not induce vomiting in the patient who is not awake and alert. For specific treatment of ingested substances, refer to the section on poisons.

There are numerous other psychiatric conditions that would require volumes to expound

upon. In almost all cases, first aid treatment is a calm, professional understanding demeanor without aggravating or agitating the patient. With the assaultive or hostile patient, a "show of force" may be all that is required. Almost all cases of psychiatric emergencies will present with a third party, either the family or friend of the patient, who has recognized a distinct change in the behavior pattern of the patient and who is seeking help for them.

## **DERMATOLOGIC EMERGENCIES**

Most dermatologic cases that present as emergencies are not really emergencies. The patient perceives them as such because of the sudden presentation and/or repulsive appearance or excessive discomfort. Most dermatologic conditions are treated symptomatically. The major exception to this is toxic epidermal necrolysis (TEN).

Toxic epidermal necrolysis is a condition of sudden onset characterized by excessive skin irritation, painful erythema, bullae, and exfoliation of the skin in sheets. It is also known as the scalded skin syndrome because of its appearance. It is thought to be caused by a staphylococcal infection in children and a toxic reaction to medications in adults.

Since skin is the largest single organ of the body and serves as a barrier to infection, prevention of secondary infection is of utmost concern. Treatment consists of isolation techniques, silver nitrate compresses, aggressive skin care, intravenous antibiotic therapy (Nafcillin or Methicillin) and, in drug induced cases, systemic steroids.

## **EMERGENCY CHILDBIRTH**

Every corpsman must be prepared to handle the unexpected arrival of a new life into the world. If the corpsman is fortunate, a prepackaged sterile delivery pack will be available. This will contain all the equipment needed to deliver a normal baby. If the pack is not available, imaginative improvisation of clean alternatives will be needed.

When the corpsman is faced with an imminent childbirth, the first determination to be made is whether there will be time to transport the expectant mother to a hospital. To help make this determination, the corpsman should try to find out whether or not this will be the woman's first delivery (first deliveries usually take much longer than subsequent deliveries); how far apart the contractions are (if less than 3 minutes, delivery is

approaching); whether or not a mother senses that she has to move her bowels (if so then the baby's head is well advanced down the birth canal); whether or not there is crowning (bulging) of the orifice (crowning indicates that the baby is ready to present itself); and how long it will take to get to the hospital. The corpsman must weigh the answers to these questions to decide if it will be safe to transport the patient to the hospital.

Prior to childbirth a corpsman must quickly "set the stage" to aid the event. The mother must not be allowed to go to the bathroom since the straining may precipitate the delivery in the worst possible location. Do not try to inhibit the natural process of childbirth by having the mother cross her legs. The mother should be lying back on a sturdy table, bed, or stretcher. A folded sheet or blanket should be placed under her buttocks for absorption and comfort. Remove all clothing below the waist, bend the knees and move the thighs apart, and drape the woman with clean towels or sheets. The corpsman should then don sterile gloves or, if these are not available, rewash his or her hands.

In a normal delivery, your calm professional manner and sincere reassurance to the mother will go a long way towards alleviating her anxiety and making the delivery easier for everyone. Help the woman rest and relax as much as possible between contraction. During contraction, deep, open mouth breathing will relieve some pain and straining. As the child's head reaches the area of the rectum, its pressure will cause the mother to feel an urgent need to defecate. Reassurance that this is a natural feeling and a sign that the baby will soon be born will alleviate her apprehension.

Watch for the presentation of the top of the head. Once it appears, take up your station at the foot of the bed and gently push against the head to keep it from popping out in a rush. Allow it to come out slowly. As more of the head appears, check to be sure that the umbilical cord is not wrapped around the neck. If it is, gently try to untangle it, or move one section over the baby's shoulder. If this is impossible, clamp in two places, 2 inches apart, and cut it. Once the chin emerges, use the bulb syringe from the pack to suction the nostrils and mouth while you support the head with one hand. Compress the bulb prior to placing it in the mouth or nose; otherwise, there will be a forceful aspiration into the lungs. The baby will now start a natural rotation to the left or right, away from the face down position. As this is occurring, keep the head in a natural relationship with the back. The shoulders appear next,

usually one at a time. From this point on, it is essential to remember that the baby is VERY slippery, and great care must be taken so that you do not drop it. The surface beneath the mother should extend at least 2 feet out from the buttocks so that the baby would not be hurt if it did slip out of your hands. Keep one hand beneath the baby's head, and use the other to support its emerging body.

Once the baby has been born, suction the nose and mouth again if breathing has not started. Wipe the face, nose, and mouth clean with sterile gauze. Your reward will be the baby's hearty greeting to the world.

Clamp the umbilical cord as the pulsations cease. Use two clamps from the prepackaged sterile delivery pack, 2 inches apart, with the first clamp 6 to 8 inches from the navel. Cut between the clamps. For safety, use gauze tape to tie the cord 1 inch from the clamp toward the navel. Secure the tie with a square knot. Wrap the child in a warm, sterile blanket and log the time of the child's arrival.

The placenta (afterbirth) will deliver itself in 10 to 20 minutes. This can be aided by massaging the mother's lower abdomen. Do not pull on the placenta. Log the time of its delivery, and wrap it up for hospital analysis.

Place a small strip of tape (1/2 inch wide), folded and inscribed with the date, time of delivery, and mother's name, around the baby's wrist.

## **COMPLICATIONS IN CHILDBIRTH**

### **Breech Delivery**

If the baby's legs and buttocks emerge first, follow the steps for a normal delivery, supporting the lower extremities with one hand. If the head does not emerge within 3 minutes, try to maintain an airway by gently pushing fingers into the vagina, pushing the vagina away from the face and opening the baby's mouth with one finger. Get medical aid immediately.

### **Prolapsed Cord**

If the cord precedes the baby, protect it with moist, sterile wraps. If a physician cannot be reached soon, place the mother in an extreme shock position, give her oxygen if available, and gently move your gloved hand into the vagina to keep its walls and the baby from compressing the cord. Get medical aid immediately.

### **Excessive Bleeding**

If bleeding is severe, treat the mother for shock and give her oxygen. Place sanitary napkins over the vaginal entrance and rush her to a hospital.

### **Limb Presentation**

If a single limb presents itself first, get the mother immediately to a hospital.

## **RESCUE AND TRANSPORTATION PROCEDURES**

It is a basic principle of first aid that an injured person must be given essential treatment BEFORE being moved. However, it is impossible to treat an injured person who is in a position of immediate danger. If the victim is drowning, or if his or her life is endangered by fire, steam, electricity, poisonous or explosive gases, or other hazards, rescue must take place before first aid treatment can be given.

The life of an injured person may well depend upon the manner in which rescue and transportation to a medical treatment facility are accomplished. Rescue operations must be accomplished quickly, but unnecessary haste is both futile and dangerous. After rescue and essential first aid treatment have been given, further transportation must be accomplished in a manner that will not aggravate the injuries. As a corpsman it may be your responsibility to direct, and be the primary rescuer in, these operations. The life and safety of the victim and the members of the rescue team may rest on your decisions.

In this section, we will consider the use of common types of protective equipment, phases of rescue operations, ways of effecting rescue from dangerous situations, emergency methods of moving injured persons to safety, and procedures for transporting them after first aid has been given.

## **PROTECTIVE EQUIPMENT**

The use of appropriate items of protective equipment will increase your ability to effect rescue from life-threatening situations. Protective equipment that is generally available on naval vessels and some shore activities include the oxygen breathing apparatus (OBA); hose (air line) masks; protective (gas) masks; asbestos suits; steel-wire life lines; and devices for detecting

oxygen insufficiency, explosive vapors, and some poisonous gases.

### **Oxygen Breathing Apparatus**

An oxygen breathing apparatus (OBA) is provided for emergency use in compartments containing toxic gases and lacking sufficient oxygen to support life. The apparatus is particularly valuable for rescue purposes because it is a self-contained unit. The wearer is not dependent upon outside air or any type of air line within the effective life of the canister.

There are several types of oxygen breathing apparatus, but they are all similar in operation. Independence of the outside atmosphere is achieved by having air within the apparatus circulated through a canister. Within the canister, oxygen is continuously generated. The effective life of the canister varies from 20 to 45 minutes, depending on the particular apparatus and the type of work being done. One of the newer types of oxygen breathing apparatus is designed so that you can change canisters without leaving the toxic atmosphere.

If you are to enter an extremely hazardous area, you should also wear a life-line. The life-line should be tended by two persons, one of whom is also wearing a breathing apparatus.

Never allow oil or grease to come in contact with any part of an oxygen breathing apparatus. Oxygen is violently explosive in the presence of oil or grease. If any part of the apparatus becomes contaminated with oil or grease smudges, clean it before it is stowed. Care should be taken to prevent oil or oily water from entering the canister between the time it is opened and the time of disposal.

### **Hose (Air Line) Masks**

Hose masks are part of the allowance of all ships having repair party lockers. They are smaller than the oxygen breathing outfits and can therefore be used by persons who must enter voids or other spaces that have very small access hatches. The hose or air line mask consists essentially of a gas mask facepiece with an adjustable head harness and a length of air hose. Note that the air line mask uses AIR rather than pure oxygen. It must NEVER be connected to an oxygen bottle, oxygen cylinder, or other source of oxygen; even a small amount of oil or grease in the air line could combine rapidly with the oxygen and cause an explosion. When properly connected to

a suitable source of air, such as the low-pressure ship's service air line, the hose mask can be worn safely, even in spaces containing a high concentration of oil or gasoline vapors; for this service, the air line mask is superior to the oxygen breathing apparatus.

Safety belts are furnished with each air line mask and MUST BE WORN. A life-line must be fastened to the safety belt; and the life-line should be loosely lashed to the air hose to reduce the possibility of fouling. The air hose and life-line must be carefully tended at all times, so that they will not become fouled or cut. The person wearing the airline mask and the person tending the lines should maintain communication by means of standard divers' signals.

### **Protective (Gas) Masks**

Protective masks provide respiratory protection against chemical, biological, and radiological warfare agents. They do not provide protection from the effects of carbon monoxide, carbon dioxide, and a number of industrial gases. Protection from these gases is discussed in the section "Rescue from Unventilated Compartments."

In emergencies, protective masks may be used for passage through a smoke-filled compartment or for entry into such a compartment to perform a job that can be done quickly, such as close a valve, secure a fan, or de-energize a circuit. However, they provide only limited protection against smoke. The length of time you can remain in a smoke-filled compartment depends on the type of smoke and its concentration.

The most important thing to remember about protective masks is that they do not manufacture or supply oxygen. They merely filter the air as it passes through the canister. Therefore, the protective mask should not be used in air containing less than 16 percent oxygen, or having a heavy concentration of smoke from oil fires excepts for very short periods of time.

### **Asbestos Suits**

The Navy asbestos suit is made in a single unit, is easy to get into, and provides complete cover for the wearer. With it on, a firefighter can move quickly through flame to effect a rescue or to perform some other job that can be done quickly.

While asbestos will not burn, it will char and conduct heat. Therefore, the suit provides protection against flame only for short periods of time. The length of time the suit can be worn

depends upon the conditions under which it is used. The person wearing the suit should return immediately to a safe, cool area if he or she experiences severe discomfort such as difficulty in breathing or extreme heat. Heavy clothing should be worn under the suit to give additional protection from heat.

If the asbestos suit becomes wet, as is more than likely in firefighting, the wearer might be scalded unless withdrawal from the heated area is accomplished before the water turns to steam. Continued wetting will keep the wearer cool, but the suit will become water soaked and reduce freedom of movement, already restricted by the cumbersome suit.

### Life-lines

The life-line is a steel-wire cable, 50 feet long. Each end is equipped with a strong hook that closes with a snap catch. The line is very pliable and will slide freely around obstructions. See figure 4-76.

Life-lines are used as a precautionary measure to aid in the rescue of persons wearing rescue breathing apparatus, hose masks, or similar equipment. Rescue, if necessary, should be accomplished by having another person equipped with a breathing apparatus follow the life-line to the person being rescued, rather than by attempting to drag the person out. Attempts to drag a person from a space may result in fouling the

life-line on some obstruction or in parting the harness, in which case it would still be necessary to send a rescue person into the space.

An important point to remember is that a stricken person must never be hauled by a life-line attached to the waist. The victim may be dragged along the deck a short distance, but his or her weight must never be suspended on a line attached to the waist. If not wearing a harness of some kind, pass the line around the chest under the armpits and fasten it in front or in back.

When tending a life-line, you must wear gloves to be able to handle the line properly. Play out the line carefully, so that it will not foul. Try to keep the life-line in contact with grounded metal; do not allow it to come in contact with any energized electrical equipment.

### Detection Devices

The detection devices used to test the atmosphere in closed or poorly ventilated spaces include the OXYGEN INDICATOR, for detecting oxygen deficiency; COMBUSTIBLE-GAS INDICATORS, for determining the concentration of explosive vapors; and TOXIC-GAS INDICATORS, such as the CARBON MONOXIDE INDICATOR for finding the concentration of certain poisonous gases. The devices are extremely valuable and should be used whenever necessary; however, they **MUST BE USED ONLY AS DIRECTED**. Improper operation of these devices may lead to false assurances of safety or, worse yet, to an increase in the actual danger of the situation. For example, the use of a flame safety lamp in a compartment filled with acetylene or hydrogen could cause a violent explosion.

### RESCUE PROCEDURES

If you are faced with the problem of rescuing a person threatened by fire, explosive or poisonous gases, or some other emergency, do not take any action until you have had time to determine the extent of the danger and your ability to cope with it. In a large number of accidents the rescuer rushes in and becomes the second victim. Do not take unnecessary chances! Do not attempt any rescue that needlessly endangers your own life!

### Phases of Rescue Operations

In disasters where there are multiple patients (as in explosions or ship collisions), rescue

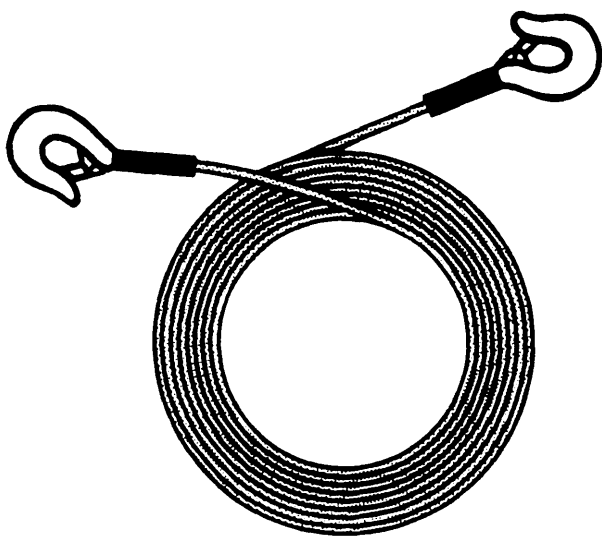


Figure 4-76.—Steel wire life-line.

136.36

operations should be performed in phases. These rescue phases apply only to extrication operations.

The first phase is to remove lightly pinned casualties, such as those who can be freed by lifting boxes or removing a small amount of debris.

In the second phase remove those casualties who are trapped in more difficult circumstances but who can be rescued by use of the equipment at hand and in a minimum amount of time.

In the third phase remove casualties where extrication is extremely difficult and time consuming. This type of rescue may involve cutting through decks, breaching bulkheads, removing large amounts of debris, or cutting through an expanse of metal. An example would be rescuing a worker from beneath a large, heavy piece of machinery.

The last phase is the removal of dead bodies.

### Stages of Extrication

The first stage of extrication within each of the rescue phases outlined above is gaining access to the victim. Much will depend on the location of the accident, damage within the accident site, and the position of the victim. The means of gaining access must also take into account the possibility of causing further injury to the victim since force may be needed. Further injury must be minimized.

The second stage involves giving lifesaving emergency care. If necessary, establish and maintain an open airway, start artificial respiration, and control hemorrhage.

The third stage is disentanglement. The careful removal of debris and other impediments from the victim will prevent further injury to both the victim and the rescuer.

The fourth stage is preparing the victim for removal, with special emphasis on the protection of possible fractures.

The final stage, removing the victim from the trapped area and transporting to an ambulance or sickbay, may be as simple as helping the victim walk out of the area or as difficult as a blanket dragged out of a burning space.

### Rescue from Fire

If you must go to the aid of a person whose clothing is on fire, try to smother the flames by wrapping the victim in a coat, blanket, or rug. Leave the head **UNCOVERED**. If you have no material with which to smother the fire, roll the victim over—**SLOWLY**—and beat out the flames with your hands. Beat out the flames around the head and shoulders, and then work downward toward the feet. If the victim tries to run, throw

him or her down. Remember that the victim **MUST** lie down while you are trying to extinguish the fire. Running will cause the clothing to burn rapidly. Sitting or standing may cause the victim to be killed instantly by inhaling flames or hot air.

**CAUTION:** Inhaling flame or hot air can kill **YOU**, too. Do not get your face directly over the flames. Turn your face away from the flame when you inhale.

If your own clothing catches fire, roll yourself up in a blanket, coat, or rug. **KEEP YOUR HEAD UNCOVERED**. If material to smother the fire is not available, lie down, roll over slowly, and beat at the flames with your hands.

If you are trying to escape from an upper floor of a burning building, be very cautious about opening doors into hallways or stairways. Always feel a door before you open it; if it feels hot, do not open it if there is any other possible way out. Remember, also, that opening doors or windows will create a draft and make the fire worse; so do not open any door or window until you are actually ready to get out.

If you are faced with the problem of removing an injured person from an upper story of a burning building, you may be able to improvise a life-line by tying sheets, blankets, curtains, or other materials together, using square knots. Secure one end around some heavy object inside the building, and fasten the other end around the casualty under the arms. You can lower the victim to safety and then let yourself down the line. Do not jump from an upper floor of a burning building except as a last resort.

It is often said the the “best” air in a burning room or compartment is near the floor, but this is true only to a limited extent. There is less smoke and flame down low, near the floor, and the air may be cooler; but carbon monoxide and other deadly gases are just as likely to be present near the floor as near the ceiling. If possible, use an oxygen breathing apparatus or other protective breathing equipment when you go into a burning compartment. If protective equipment is not available, cover your mouth and nose with a wet cloth to reduce the danger of inhaling smoke, flame, or hot air. **REMEMBER, HOWEVER, THAT A WET CLOTH GIVES YOU NO PROTECTION AGAINST POISONOUS GASES OR LACK OF OXYGEN!**

### Rescue from Steam-filled Spaces

It is sometimes possible to rescue a person from a space in which there is a steam leak. Since

steam rises, escape upward may not be possible. If the normal exit is blocked by escaping steam, move the casualty to the escape trunk or, if there is none, to the lowest level in the compartment.

The equipment that offers protection against fire does NOT protect you against steam. In particular, it should be mentioned that the asbestos suit absorbs water and is therefore of no value in a steam-filled space. Steam would penetrate the asbestos very quickly, and the person wearing the suit would be scalded.

### **Rescue from Electrical Contact**

Rescuing a person who has received an electrical shock is likely to be difficult and dangerous. Extreme caution must be used, or you may be electrocuted yourself.

#### **YOU MUST NOT TOUCH THE VICTIM'S BODY, THE WIRE, OR ANY OTHER OBJECT THAT MAY BE CONDUCTING ELECTRICITY.**

Look for the switch first of all; if you find it, turn off the current immediately. Do not waste too much time hunting for the switch; every second is important.

If you cannot find the switch, try to remove the wire from the victim with a DRY broom handle, branch, pole, oar, board, or similar NON-CONDUCTING object. It may be possible to use a DRY rope or DRY clothing to pull the wire away from the victim. You can also break the contact by cutting the wire with a WOODEN-HANDLED axe, but this is extremely dangerous because the cut ends of the wire are likely to curl and lash back at you before you have time to get out of the way. When you are trying to break an electrical contact, always stand on some nonconducting material such as a DRY board, DRY newspapers, or DRY clothing (see figure 4-74).

### **Rescue from Unventilated Compartments**

Rescuing a person from a void, double bottom, gasoline or oil tank, or any closed compartment or unventilated space is generally a very hazardous operation. Aboard naval vessels and at naval shore activities, no person is permitted to enter any such space or compartment until a damage control officer (DCO), or some person designated by the DCO, has indicated that the likelihood of suffocation, poisoning, and fire or explosion have been eliminated as far as possible. The rescue of a person from any closed space should therefore be performed under the supervision of the DCO or in accordance with the DCO's instructions. In general, it is necessary to observe the following precautions when attempting to

rescue a person from any closed or poorly ventilated space:

1. If possible, test the air for oxygen deficiency, poisonous gases, and explosive vapors.
2. Wear a hose (air line) mask or oxygen breathing apparatus. The air line mask is preferred for use in spaces that may contain high concentrations of oil or gasoline vapors. Do not depend upon a protective mask or a wet cloth held over your face to protect you from oxygen deficiency or poisonous gases.
3. Before going into a compartment that may contain explosive vapors, be sure that people are stationed nearby with fire-extinguishing equipment.
4. When going into any space that may be deficient in oxygen or contain poisonous or explosive vapors, be sure to maintain communication with someone outside. Wear a life-line, and be sure that it is tended by a competent person.
5. Do not use, wear, or carry any object or material that might cause a spark. Matches, cigarette lighters, flashlights, candles or other open flames, and ordinary electrical lights must NEVER be taken into a compartment that may contain explosive vapors. The kind of portable light used by cleaning parties in boilers, fuel tanks, and similar places may be taken into a suspect compartment; this is a steam-tight, glove-type light whose exposed metal parts are either made of nonsparking alloy or protected in some way so they will not strike a spark.

Electrical apparatus or tools that might spark must never be taken into a compartment until a DCO has indicated that it is safe to do so. When electrical equipment is used (e.g., an electric blower might be used to vent a compartment of explosive vapors) it must be explosion proof and properly grounded.

If you go into a space that may contain explosive vapors, do not wear clothing that has any exposed spark producing metal. For example, do not wear boots or shoes that have exposed nailheads or rivets, and do not wear coveralls or other garments that might scrape against metal and cause a spark.

A particular caution must be made concerning the use of the steelwire life-line in compartments that may contain explosive vapors. If you use the line, be sure that it is carefully tended and properly

grounded at all times. When other considerations permit, you should use a rope line instead of the steel-wire life-line when entering compartments that may contain explosive vapors.

### Rescue from the Water

You should never attempt to swim to the rescue of a drowning person unless you have been trained in lifesaving methods—and then only if there is no better way of reaching the victim. A drowning person may panic and fight against you so violently that you will be unable either to carry out the rescue or to save yourself. Even if you are not a trained lifesaver, however, you can help a drowning person by holding out a pole, oar, branch, or stick for the victim to catch hold of or by throwing a life-line or some buoyant object that will support the victim in the water.

Various methods are used aboard ship to pick up survivors from the water. The methods used in any particular instance will depend upon weather conditions, the type of equipment available aboard the rescue vessel, the number of people available for rescue operations, the physical condition of the people requiring rescue, and other factors. In many cases it has been found that the best way to rescue a person from the water is to send out a properly trained and properly equipped swimmer with a life-line.

It is frequently difficult to get survivors up to the deck of the rescuing vessel, even after they have been brought alongside the vessel. Cargo nets are often used, but many survivors are unable to climb them without assistance. Persons equipped with life-lines (and, if necessary, dressed in anti-exposure suits) can be sent over the side to help survivors up the nets. If survivors are covered with oil, it may take the combined efforts of four or five people to get one survivor up the net.

A seriously injured person should never, except in an extreme emergency, be hauled out of the water by means of a rope or life-line. Special

methods must be devised to provide proper support, to keep the victim in a horizontal position, and to provide protection from any kind of jerking, bending, or twisting motion. The Stokes stretcher (described later in this chapter) can often be used to rescue an injured survivor. The stretcher is lowered into the water, and the survivor is floated into position over it. People on the deck of the ship can then bring the stretcher up by means of handlines. Life preservers, balsa wood, unicellular material, or other flotation gear can be used if necessary to keep the stretcher afloat.

### Moving the victim to Safety

In an emergency, there are many ways to move a victim to safety, ranging from one-person carries to stretchers and spineboards. The victim's conditions and the immediacy of danger will dictate the appropriate methods, but remember to give all necessary first aid BEFORE moving the victim.

### Stretchers

The military uses a number of standard stretchers. The following discussion will familiarize you with the most common types. When using a stretcher, you should consider a few general rules:

1. Use standard stretchers when available, but be ready to improvise safe alternatives.
2. When possible, bring the stretcher to the casualty.
3. Always fasten the victim securely to the stretcher.
4. Always move the victim FEET FIRST so the rear bearer can watch for signs of breathing difficulty.

**STOKES STRETCHER.**— The Navy service litter most commonly need for transporting sick or injured persons is called the stokes stretcher. As shown in figure 4-77, the Stokes stretcher is essentially a wire basket supported by iron rods,

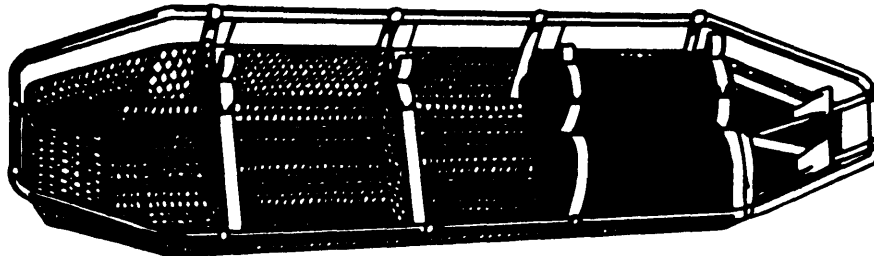


Figure 4-77.—Stokes stretcher.

but a new version is made of molded plastic. It is adaptable to a variety of uses, since the casualty can be held securely in place even if the stretcher is tipped or turned. The Stokes stretcher is particularly valuable for transferring injured persons to and from boats. As mentioned before, it can be used with flotation devices to rescue injured survivors from the water. It is also used for direct ship-to-ship transfer of injured persons. Fifteen-foot handling lines are attached to each end for shipboard use in moving the victim.

The Stokes stretcher should be padded with three blankets: two of them should be placed lengthwise, so that one will be under each of the casualties legs, and the third should be folded in half and placed in the upper part of the stretcher to protect the head and shoulders. The casualty should be lowered gently into the stretcher and made as comfortable as possible. The feet must be fastened to the end of the stretcher so that the casualty will not slide down. Another blanket (or more, if necessary) should be used to cover the casualty. The casualty must be fastened to the stretcher by means of straps that go over the chest, hips, and knees. Note that the straps go OVER the blanket or other covering, thus holding it in place.

**ARMY LITTER.**— The Army litter, shown in figure 4-78, is a collapsible stretcher made of

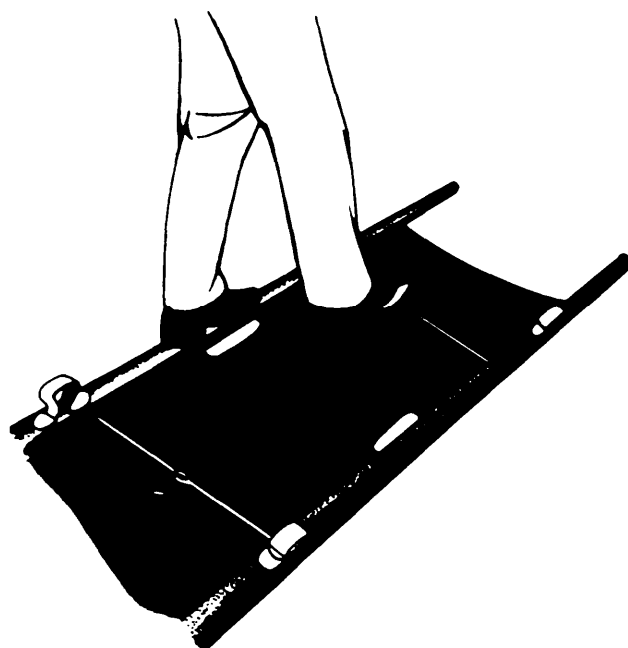


Figure 4-78.—Opening an Army litter.

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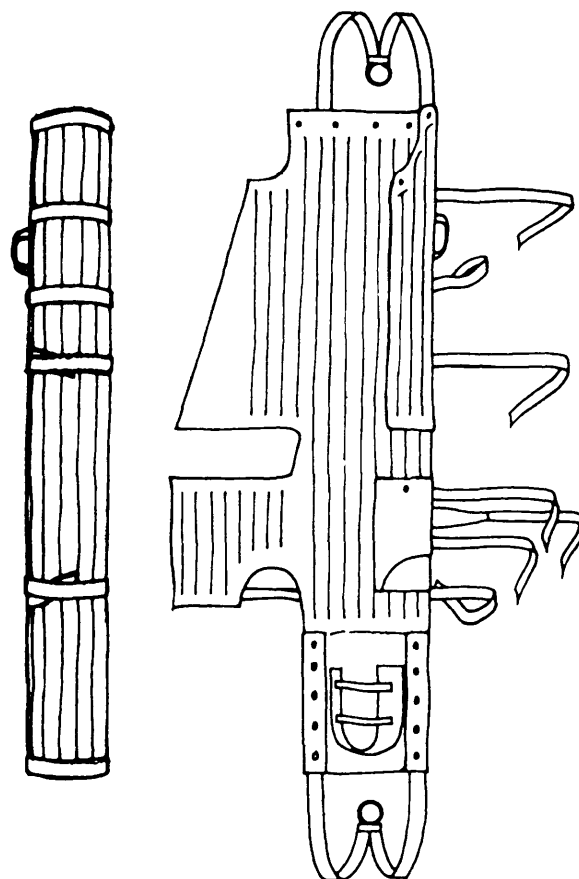


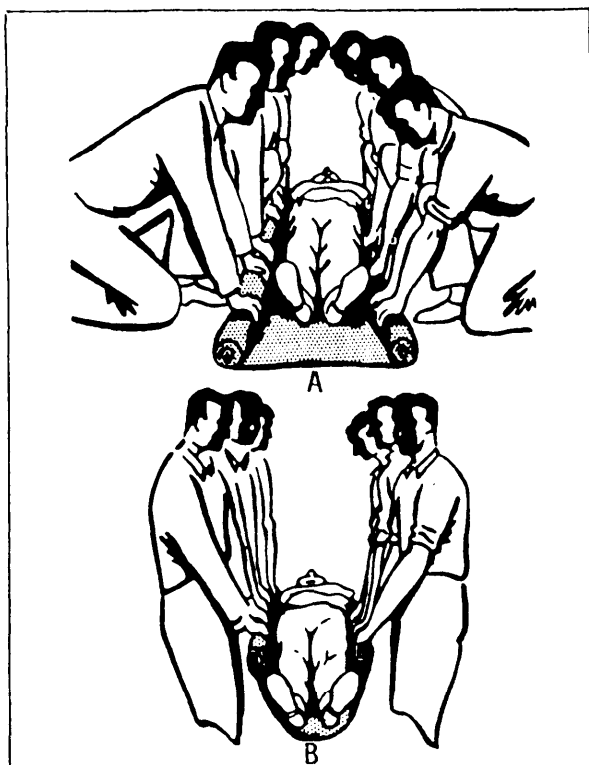
Figure 4-79.—Neil Robertson stretcher.

154.160

canvas and supported by wooden or aluminum poles. It is very useful for transporting battle casualties in the field. However, it is sometimes difficult to fasten the casualty onto the Army litter, and for this reason its use is somewhat limited aboard ship. The litter legs keep the patient off the ground and fit it into the restraining tracks of a jeep or field ambulance to hold the litter in place during transport.

**NEIL ROBERTSON STRETCHER.**— The Neil Robertson stretcher is especially designed for removing an injured person from engine rooms, holds, and other compartments where access hatches are too small to permit the use of regular stretchers. You can also use it to hoist a casualty aboard a hovering helicopter by attaching a rescue line.

The Neil Robertson stretcher is made of semirigid canvas with sewn-in wooden slats sewn the length of the stretcher. When firmly wrapped



136.49

Figure 4-80.—Blanket used as an improvised stretcher.

around the casualty mummy-fashion, it gives sufficient support for a vertical lift (fig. 4-79). A guideline is tied to the bottom ring to keep the casualty from swaying against bulkheads and hatchways while being lifted.

Stretchers of this type can be made on board ship and kept in appropriate places ready for use. If a Neil Robertson stretcher is not available when needed, a piece of heavy canvas, wrapped firmly around the casualty, will serve somewhat the same purpose. Periodically check your ship's Neil Robertson stretchers for dry rot or other damaged caused by humidity, sea water, or handling.

**IMPROVISED STRETCHERS.**— Standard stretchers should be used whenever possible to transport a seriously injured person. If none are available, it may be necessary for you to improvise. Shutters, doors, boards, and even ladders may be used as stretchers. All stretchers of this kind must be very well padded and great care must be taken to see that the casualty is fastened securely in place.

Sometimes a blanket may be used as a stretcher, as shown in figure 4-80. The casualty is placed in the middle of the blanket in the supine position. Three or four people kneel on each side and roll the edges of the blanket toward the casualty, as shown in figure 4-80A. When the rolled edges are tight and large enough to grasp securely, the casualty should be lifted and carried as shown in figure 4-80B.

Stretchers may also be improvised by using two long poles (about 7 feet long) and strong cloth, such as a rug, a blanket, a sheet, a mattress cover, two or three gunny sacks, or two coats. Figure 4-81 shows an improvised stretcher made from two poles and a blanket.

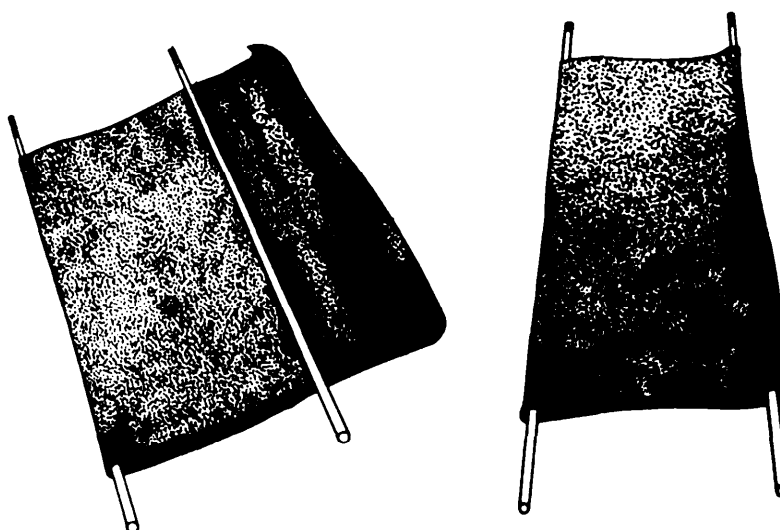


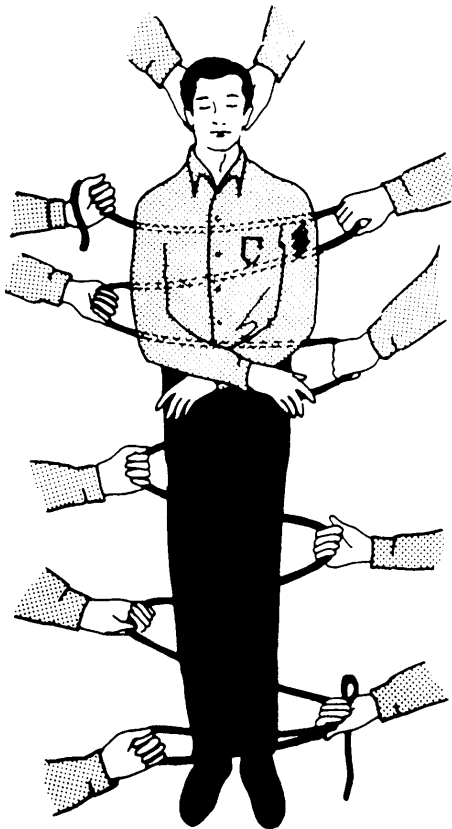
Figure 4-81.—Improvised stretcher using blankets and poles.

136.50A

**CAUTION:** Many improvised stretchers do not give sufficient support in cases where there are fractures or extensive wounds of the body. They should be used only when the casualty is able to stand some sagging, bending, or twisting without serious consequences. An example of this type of improvised stretcher would be one made of 40 to 50 feet of rope or 1 1/2-inch firehose (fig. 4-82).

**SPINEBOARDS.**— Spineboards are essential equipment in the immobilization of suspected or real fractures of the spinal column. Made of fiberglass or exterior plywood, they come in two sizes, short (18" x 32") and long (18" x 72"), and are provided with handholds and straps, and have a runner on the bottom to allow clearance to lift (fig. 4-83).

A short spineboard is primarily used in extrication of sitting victims, especially in automobile wrecks, where it would be difficult to maneuver



154.161  
Figure 4-82.—Improvised stretcher using rope or firehose.

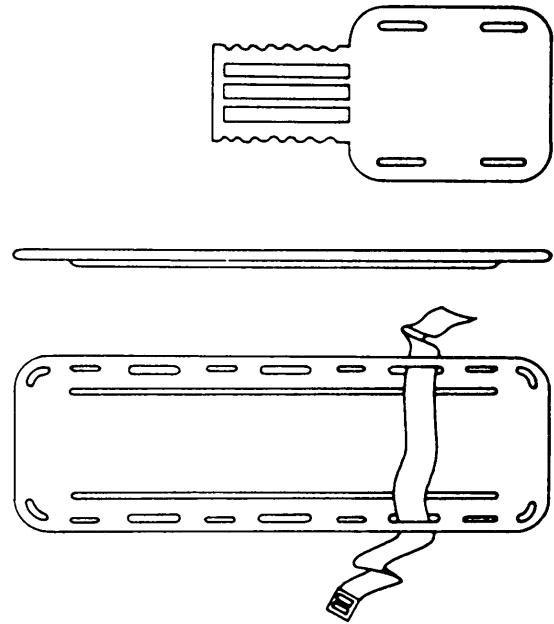


Figure 4-83.—Spineboards.

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the victim out of position without doing additional damage to the spine. The long board makes a firm litter, protecting the back and neck, and providing a good surface for CPR and a good sliding surface for difficult extrications. The short and long boards are often used together. For example, at an automobile accident site, the corpsman's first task is to assess the whole situation and to plan the rescue. If bystanders must be used, it is essential that they be thoroughly briefed, in detail, on what you want them to do. After all accessible bleeding has been controlled and the fractures splinted, the short spineboard should be moved into position behind the victim. A neck collar should be applied in all cases and will aid in the immobilization of the head and neck. The head should then be secured to the board with a headband or a 6-inch self-adhering roller bandage. The victim's body is then secured to the board by use of the supplied straps around the chest and thighs. The victim may then be lifted out. If, however, the victim is too large, or further immobilization of the lower extremities is necessary, the long spineboard may be slid at a right angle behind the short spineboard, and the victim is maneuvered onto his or her side and secured to the long board.

The possible uses of the spineboard in an emergency situation are limited only by the imagination of the rescuers.

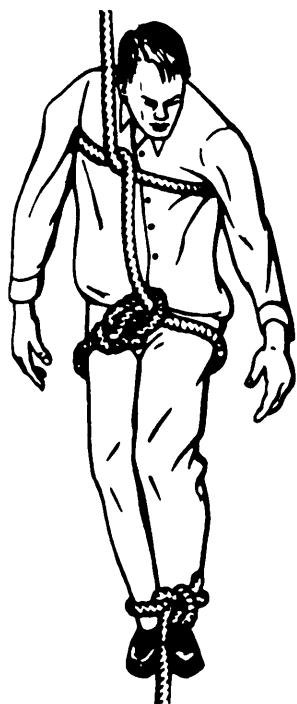


Figure 4-84.—Hoisting a person.

## Lifts, Drags, and Carries

**EMERGENCY RESCUE LINES.** —As previously mentioned, the steel-wire life-line can often be used to haul a person to safety. An emergency rescue line can also be made from any strong fiber line. Both should be used only in extreme emergencies, when an injured person must be moved and no other means is available. Figure 4-84 shows an emergency rescue line that could be used to hoist a person from a void or small compartment. Notice that a running bowline is passed around the body, just below the hips, and a half hitch is placed just under the arms. Notice also that a guideline is tied to the casualty's ankles to prevent banging against bulkheads and hatchways.

**FIREMAN'S CARRY.** —One of the easiest ways to carry an unconscious person is by means of the fireman's carry. Figure 4-85 shows the procedure.

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1. Place the casualty in the prone position, as shown in figure 4-85A. Face the victim, and

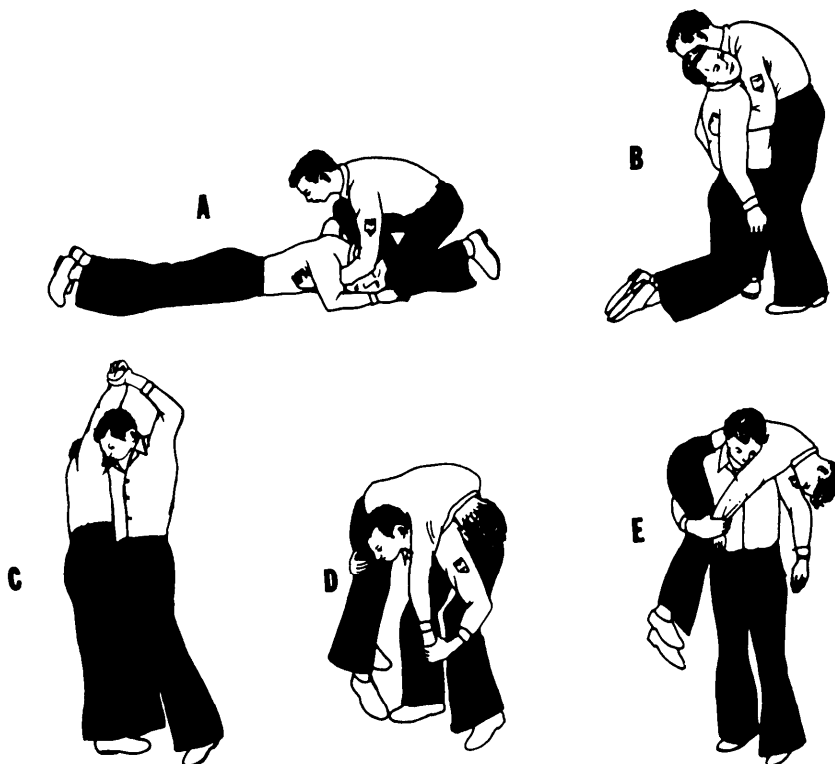
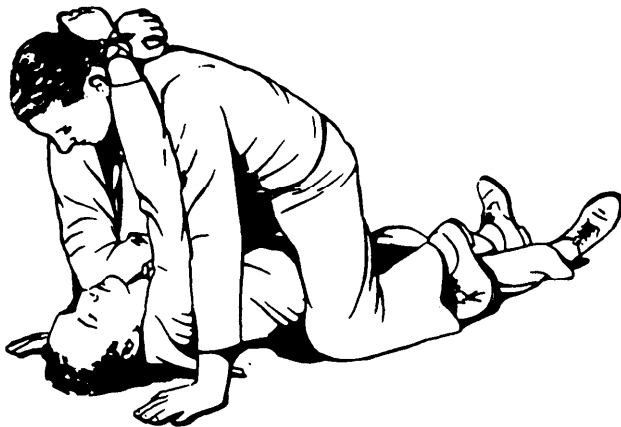


Figure 4-85.—Fireman's carry.

136.39

kneel on one knee at his or her head. Pass your hands under the armpits; then slide your hands down the sides and clasp them across the back.

2. Raise the casualty to the kneeling position as shown in figure 4-85B. Take a better hold across the back.
3. Raise the casualty to a standing position and place your right leg between the legs, as shown in figure 4-85C. Grasp the right wrist in your left hand and swing the arm around the back of your neck and down your left shoulder.
4. Stoop quickly and pull the casualty across your shoulders and, at the same time, put your right arm between the legs, as shown in figure 4-85D.
5. Grasp the right wrist with your right hand and straighten up, as shown in figure 4-85E.



136.40

Figure 4-86.—Tied hands crawl.

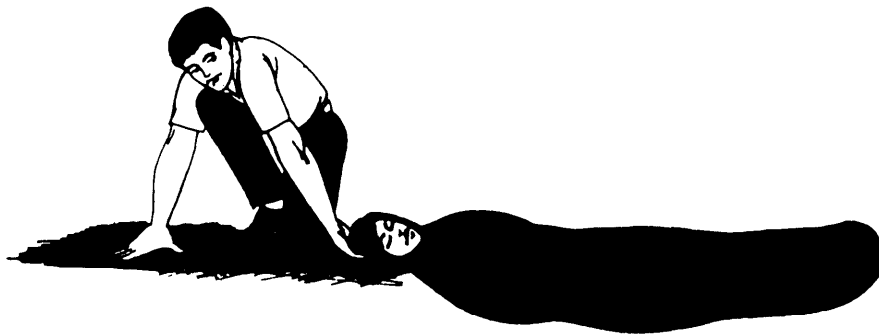
**TIED-HANDS CRAWL.**— The tied-hands crawl, shown in figure 4-86, may be used to drag an unconscious person for a short distance. It is particularly useful when you must crawl underneath a low structure, but it is the least desirable because the victim's head is not supported.

To be carried by this method, the casualty must be in the supine position. Cross the wrists and tie them together. Kneel astride the casualty and lift the arms over your head so that the wrists are at the back of your neck. When you crawl forward, raise your shoulders high enough so that the casualty's head will not bump against the deck.

**BLANKET DRAG.**— The blanket drag, shown in figure 4-87, can be used to move a person who, due to the severity of the injury, should not be lifted or carried by one person alone. Place the casualty in the supine position on a blanket and pull the blanket along the floor or deck. Always pull the casualty head first, with the head and shoulders slightly raised, so that the head will not bump against the deck.

**PACK-STRAP CARRY.**— With the pack-strap carry, shown in figure 4-88, it is possible to carry a heavy person for some distance. Use the following procedure:

1. Place the casualty in a supine position.
2. Lie down on your side along the casualty's uninjured or less injured side. Your shoulder should be next to the casualty's armpit.
3. Pull the casualty's far leg over your own, holding it there if necessary.
4. Grasp the casualty's far arm at the wrist and bring it over your upper shoulder as



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Figure 4-87.—Blanket drag.



Figure 4-88.—Packstrap carry.

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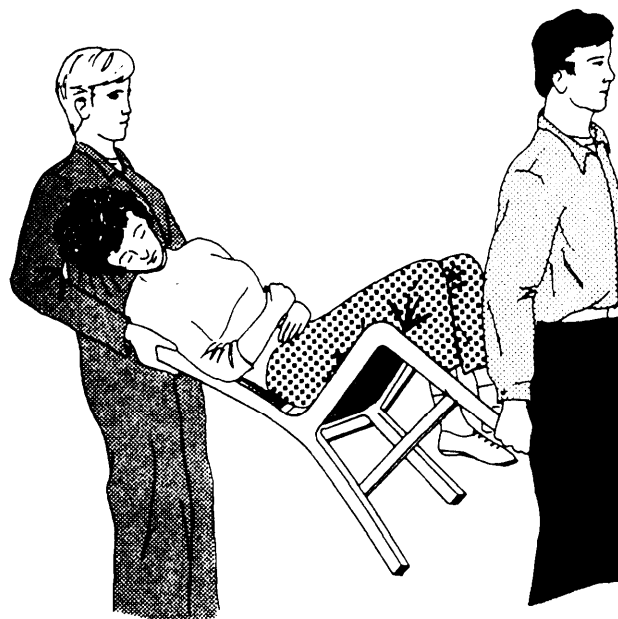


Figure 4-89.—Chair carry.

136.43

you roll and pull the casualty onto your back.

5. Raise up on your knees, using your free arm for balance and support. Hold both the casualty's wrists close against your chest with your other hand.
6. Lean forward as you rise to your feet, and keep both of your shoulders under the casualty's armpits.

Do not attempt to carry a seriously injured person by means of the pack-strap carry, especially if the arms, spine, neck, or ribs are fractured.

**CHAIR CARRY.**— The chair carry can often be used to move a sick or injured person away from a position of danger. The casualty is seated on a chair, as shown in figure 4-89, and the chair is carried by two rescuers. This is a particularly good method to use when you must carry a person up or down stairs or through narrow, winding passageways. It must NEVER be used to move a person who has an injured neck, back, or pelvis.

**ARM CARRIES.**— There are several kinds of arm carries that can be used in emergency situations to move an injured person to safety.



Figure 4-90.—One-person arm carry.

136.44

Figure 4-90 shows how one person can carry the casualty alone. However, you should never try to carry a person this way who is seriously injured. Unless considerably smaller than you are, you will not be able to carry the casualty very far by this method.

The two-person arm carry, shown in figures 4-91 and 4-92, can be used in some cases to move an injured person. However, it should not be used to carry a person who has serious wounds or broken bones.

Another two-person carry that can be used in emergencies is shown in figure 4-93. Two rescuers position themselves beside the casualty, on the same side, one at the level of the chest and the other at the thighs. The rescuers interlock their adjacent arms as shown, while they support the victim at the shoulders and knees. In unison they lift the victim and roll his or her front toward theirs. This carry must not be used to move seriously injured persons.

## TRANSPORTATION OF THE INJURED

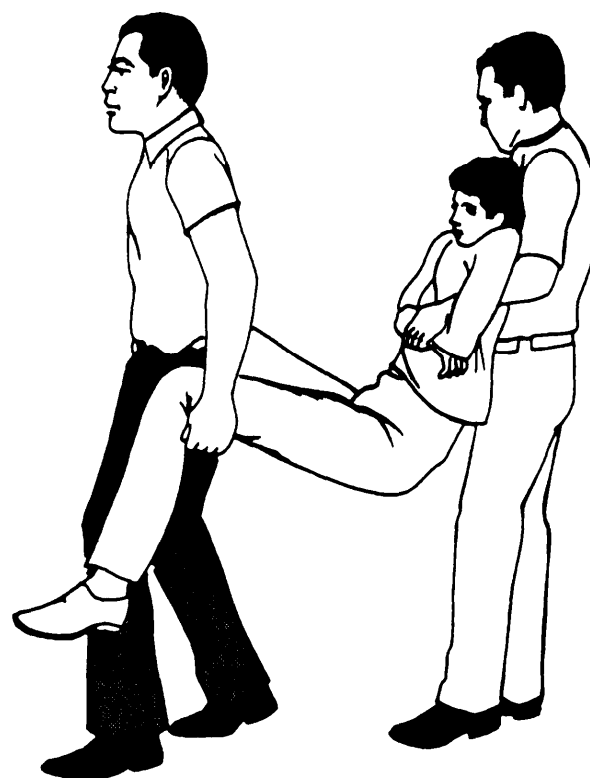
Thus far in this chapter we have dealt with EMERGENCY methods used to move an injured person out of danger and into a position where first aid can be administered. As we have seen, these emergency rescue procedures often involve substantial risk to the casualty and should be used ONLY when clearly necessary.

Once you have rescued the casualty from the immediate danger, **SLOW DOWN!** From this point on, handle and transport the casualty with every regard for the injuries that have been sustained. In the excitement and confusion that almost always accompany an accident, you are



154.163

Figure 4-91.—Two-person arm carry.



136.45

Figure 4-92.—Two-person arm carry (alternate).

likely to feel rushed, wanting to do everything rapidly. To a certain extent this is a reasonable feeling. Speed is essential in treating many injuries and in getting the casualty to a medical treatment facility. However, it is not reasonable to let yourself feel so hurried that you become careless and transport the victim in a way that will aggravate the injuries.

## Emergency Vehicles, Equipment, and Supplies

In most peacetime emergency situations, some form of ambulance will be available to transport the victim to a medical treatment facility. Navy ambulances vary in size and shape from the old "gray ghost" to modern van and modular units. Although there are many differences in design and storage capacity, most Navy ambulances are equipped to meet the same basic emergency requirements. They contain equipment and supplies for emergency airway care, artificial ventilation, suction, oxygenation, hemorrhage control, fracture immobilization, shock control, blood pressure monitoring, and poisoning. They will



154.164

Figure 4-93.—Two-person arm carry (alternate).

also contain a wheeled litter, an Army litter, and both long and short spineboards. Supplies you may find include the following:

**AIRWAYS.**— Oropharyngeal airways come in sizes for adults, children, and infants. Their use was discussed earlier in this chapter. In addition, padded tongue blades or bite sticks for convulsive seizures, and tracheotomy tubes for victims with a tracheotomy will be provided.

**ARTIFICIAL VENTILATION DEVICES.**— Ambu-Bag (1 or 2) with masks of different sizes and oxygen enrichment capability.

**SUCTION EQUIPMENT.**— Portable and/or installed suction equipment for pharyngeal and tracheotomy suction, with tubes, tips, and collection bottles.

**OXYGEN SUPPLY.**— A portable unit with an extra cylinder and masks of different sizes.

**HEMORRHAGE CONTROL.**— Sterile gauze pads, battle dressings, soft self-adhering roller bandages, adhesive tape, safety pins, and bandage scissors.

**SPLINTING SUPPLIES.**— Various materials for upper and lower extremity splints, and triangular bandages.

**SHOCK CONTROL.**— Intravenous fluids in unbreakable containers, and administration kits, as determined by local directives.

**BLOOD PRESSURE MONITORING.**— Blood pressure cuff and stethoscope.

**POISON RESPONSE.**— Ipecac syrup in measured doses.

**SPINEBOARD.**— Long and short for spinal immobilization, extrication, and as a CPR surface.

Deployed units at sea and in the field and certain commands near air stations will also have access to helicopter MEDEVAC support. Helicopters are ideal for use in isolated areas but are of limited practical use at night, in adverse weather, under certain tactical conditions, or in developed areas where building and power lines interfere. In addition to taking these factors into consideration, the corpsman must decide if the victim's condition is serious enough, or too serious, to justify a call for the helicopter. Some injuries require very smooth transportation or are affected by the pressure changes incurred in flight. The final decision will be made by the unit commander, who is responsible for requesting the helicopter support.

Field operational units will have access to field ambulances, jeeps, and "gamma-goats" for casualty transportation. They have room for two to four Army litters and are used for behind the lines movement.

#### Care en Route

The emergency care a corpsman can offer patients en route is limited only by the availability

of supplies, the level of external noise and vibrations, and the degree of skill and ingenuity the corpsman possesses.

### **Care at the Medical Treatment Facility**

Do not turn the victim over to anyone without giving a complete account of the situation, especially if a tourniquet was used or medications administered. If possible, while en route, write down the circumstances of the accident, the treatment given, and keep a log of vital signs. After turning the patient over to the medical treatment facility, ensure that depleted ambulance supplies are replaced so that the vehicle is in every way ready to handle another emergency.

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